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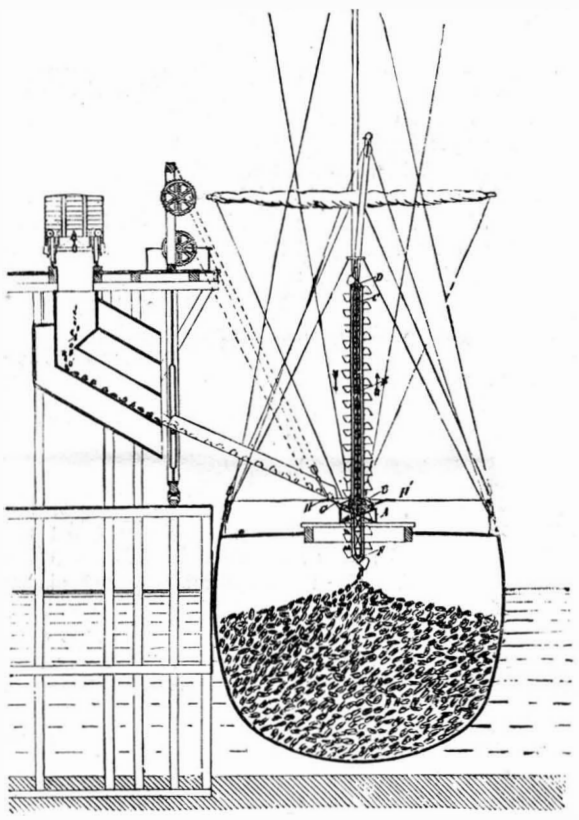
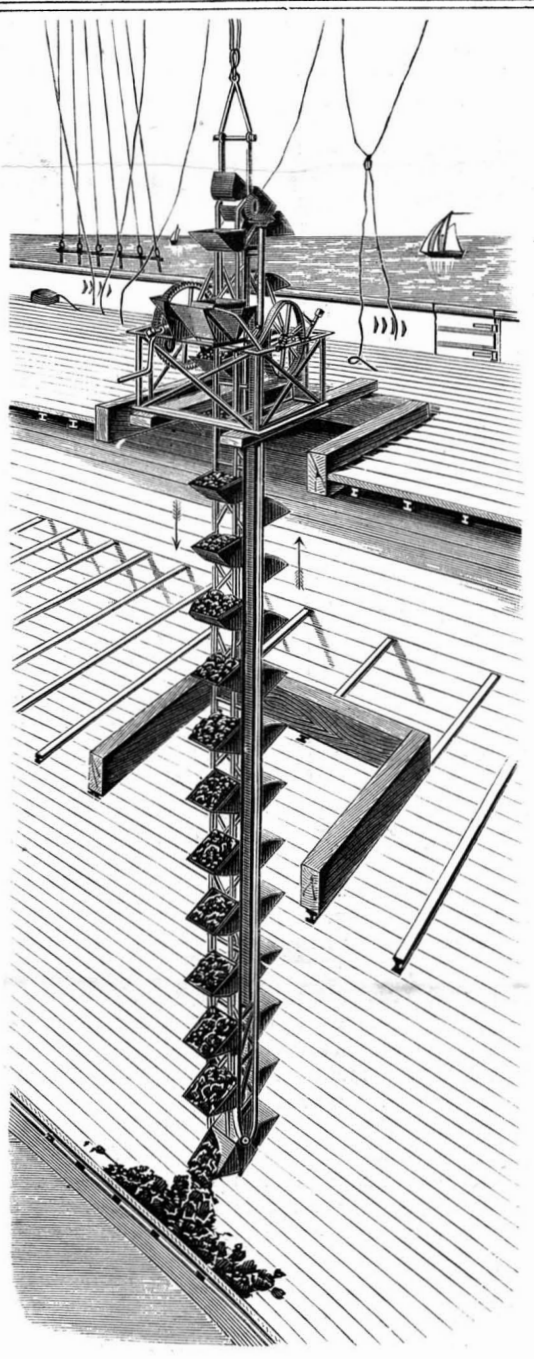
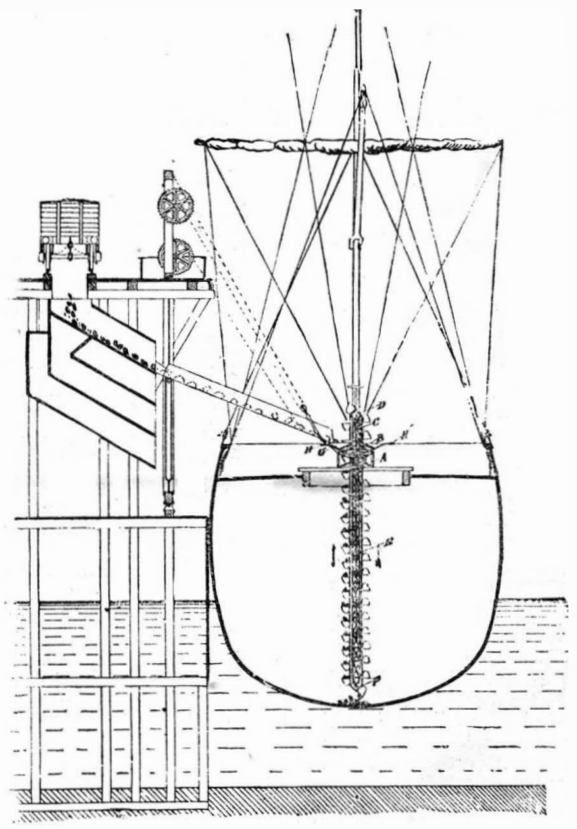
APPARATUS FOR COALING SHIPS.

In the ports of England the loading of ships with coal is generally effected in the following manner: The car coming from the mines is hauled to the upper part of a trestle-work, the bottom of the car is opened, the coal falls into a hopper, follows an inclined chute as far as the hatchway, and from there is thrown into the hold. This mode of loading is very rapid and very economical, the only disadvantage that it presents being that large coal, on falling into the hold from the end of the chute, breaks into small fragments. To obviate such a disadvantage, Mr. James Rigg has invented and constructed, in his works at Chester, an apparatus which is shown in three annexed figures, and which constitutes a system that can be employed not only for the loading of coal, but also for letting down to the bottom of the hold bricks, stones, salt, etc.

One of the figures gives a general view of the apparatus arranged in the interior of a ship's hull; and from the other





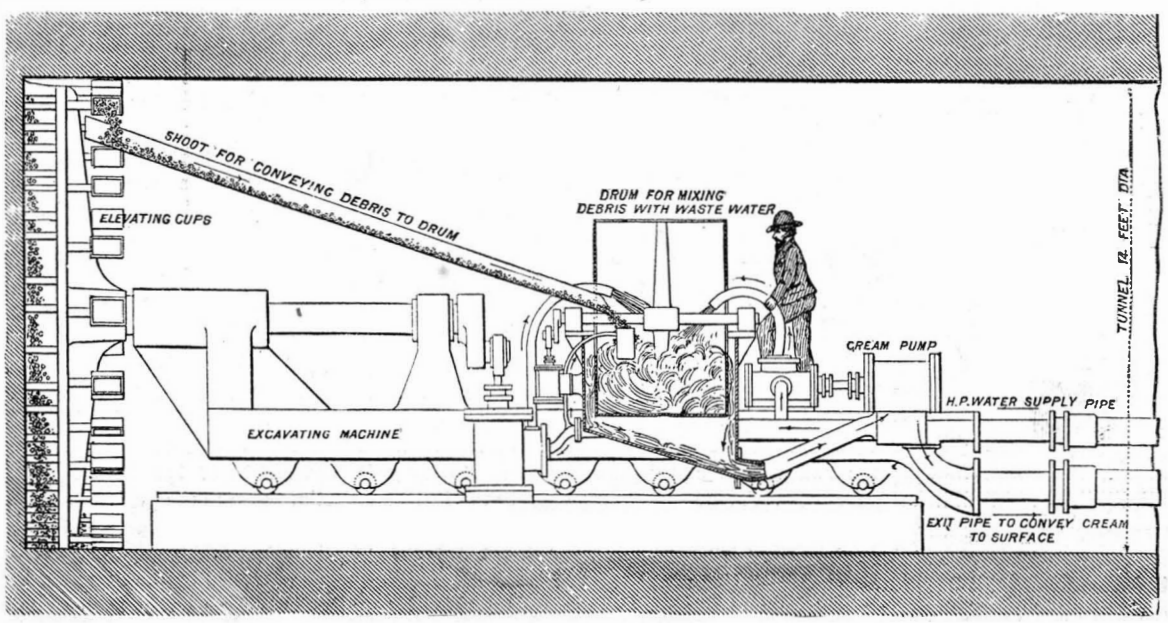


IMPROVED ELEVATORS FOR LOADING SHIPS WITH COAL BALLAST, ETC.

two figures may be seen how it operates when the loading begins and the hull is still empty, and when, the hull being nearly filled, the operation is about ended. As may be easily seen from these cuts, the apparatus is exceedingly simple, consisting of an endless chain provided with buckets, and running around a vertical bucket frame. At the upper part there is a wooden frame, to which is fixed the head of the bucket frame, and which is laid across the hatchway. The weight alone of the materals is utilized to cause the working of the endless chain, without the necessity of having recourse to a motor. The bucket frame is raised or lowered according to needs, either by the aid of a pulley installed in the masting, or by means of a small windlass fixed upon the frame. The buckets, in their descent, pass in front of an open hopper, where they become filled, and empty themselves only at the moment at which they are revolving over the lower drum at the extremity of the bucket frame.

In order to regulate the descent and prevent its taking place too rapidly, a brake is fixed on the upper frame, and serves to actuate a vertical shaft that acts upon the axle of the upper drum by means of a cone wheel. The vertical shaft, which descends nearly to the base of the bucket frame, is provided with a groove throughout its entire length, in order that the action of the brake may occur, whatever be the position of the bucket frame. Mr. Rigg's apparatus is constructed almost wholly of steel, thus causing it to be very light, while having all the strength necessary.

It is very portable, and, in the different applications that have been made of it, its working has left nothing to be desired.


SHOOT FOR CONVEYING DEBRIS TO DRUM
ELEVATING CUPS
DRUM FOR MIXING DEBRIS WITH WASTE WATER
CREAM PUMP
H.P. WATER SUPPLY PIPE
EXCAVATING MACHINE
EXIT PIPE TO CONVEY CREAM TO SURFACE
TUNNEL 12 FEET DIA

AUTOMATIC MACHINE FOR THE SUBMARINE TUNNEL BETWEEN FRANCE AND ENGLAND.

MACHINE FOR EXCAVATING THE CHANNEL TUNNEL.

An interesting lecture was lately delivered at the *conversazione* held at Leeds during the meeting of the Institution of Mechanical Engineers, by Mr. Crampton, in which he described his proposed method of executing the work of boring the Channel tunnel. We condense the following from the lecture:

The tunnel is assumed to be twenty miles long, independent of approaches on either side, to be excavated 36 feet in diameter in one operation, which, with an internal lining of 3 feet all round, will leave a clear tunnel 30 feet in diameter; and that the work will be commenced simultaneously at both ends. It follows, therefore, since the approaches may be made at the same time as the main tunnel, that we need only consider here a length of ten miles of excavation worked from one face.

Practical trials in chalk made with machines many years since, established the fact that a rate of advance may be easily maintained of one yard per hour, or twenty-four yards per day, at which rate the work of excavating ten miles of tunnel would take two and a half years to accomplish, taking the year at 300 working days. With the simple apparatus on the table, as much as five yards forward per hour has been cut 12 inches in diameter. The advance of one yard forward per hour in a 36 foot tunnel will necessitate the removal of 113 cubic yards of chalk per hour. In order to insure the due performance of the necessary work, I will add fifty per cent to the figures here given, and shall henceforth deal with other items in the same proportion. We have to provide, then, for the removal of 170 cubic yards of *débris* per hour, equal in weight to 250 tons, a greater quantity than is lifted in two of our greatest collieries together in the same time.

Near the mouth of the upright shaft powerful machinery will be erected to pump water from the sea, to press it up, and hold it under compression by means of force pumps and accumulators. The water will be compressed on the top to 512 pounds per square inch, the fall through 400 feet from the sea will add another 188 pounds per square inch, producing thus at the bottom of the shaft 700

(*Continued on page* 116.)

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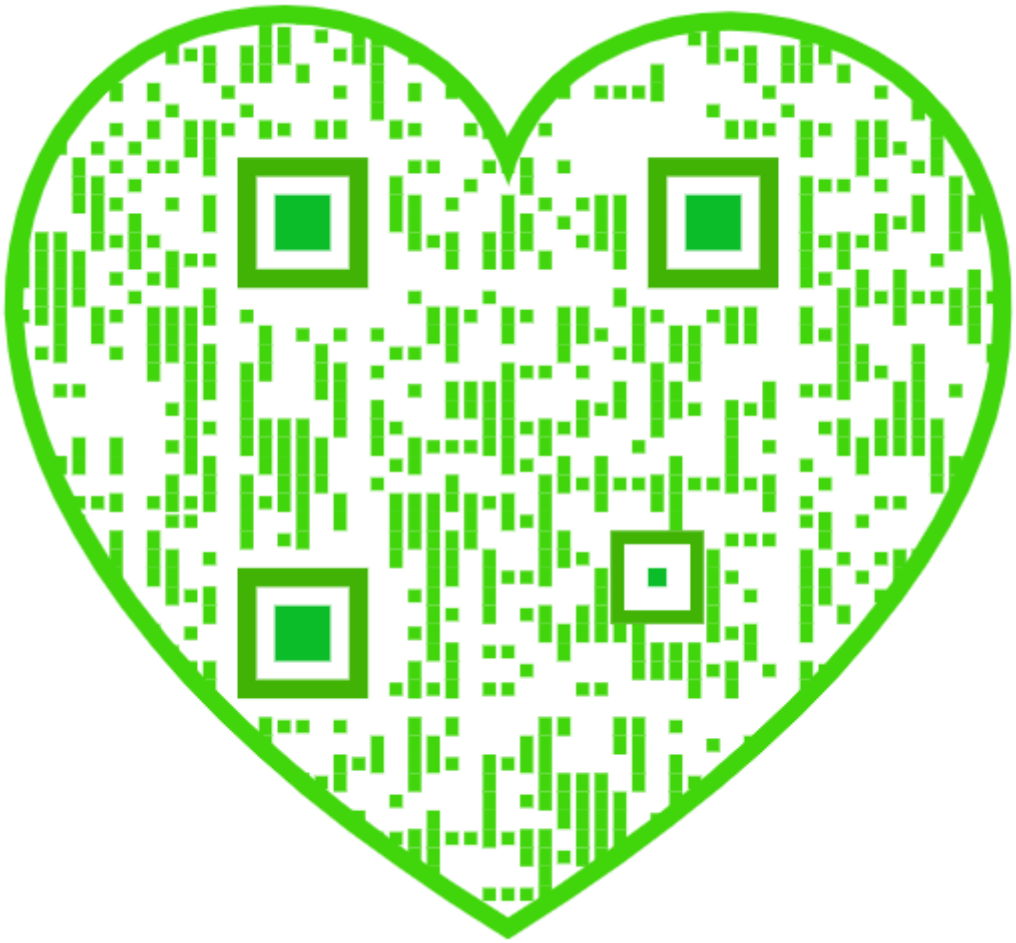

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NEW YORK, SATURDAY, FEBRUARY 24, 1883.

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PROJECTS FOR INCREASING THE WATER SUPPLY OF NEW YORK CITY.

A committee has been holding daily sessions to consider projects and receive suggestions relating to an increase in the water supply of this city. It is admitted that the need of such an increase is urgent. The largest capacity of the present Croton aqueduct is 100,000,000 gallons a day, and this at a pressure that seriously imperils the integrity of the structure. The engineers in charge agree that the aqueduct ought not to be made to carry more than 72,000,000 gallons a day. The present storage capacity is about 9,000,000,000 gallons. The Bronx River aqueduct, to be completed next year, will increase the supply about 20,000,000 gallons a day. A large proportion of the present supply is wasted. Mr. John C. Campbell, formerly chief engineer of the Croton aqueduct, estimates the waste at "about 50 per cent of the entire amount of the water furnished by the aqueduct"; this partly through the carelessness of consumers, but largely through leakage from the water-mains.

Could all the waste be prevented, the supply already provided might answer for the present, but it would soon become inadequate through the natural growth of the city. If the city increases during the next quarter century as it has during the past twenty-five years, there will be needed from 250,000,000 to 300,000,000 gallons of water a day. The question is, how can the requisite provision be made, not merely for the immediate future, but, if possible, for centuries to come?

The Department of Public Works is in favor of building a dam at Quaker Bridge, six miles below the Croton dam, to retain the water which now flows over the latter in seasons of abundance, with a new aqueduct to deliver the water thus saved. The supply of the Croton watershed, it is claimed, is sufficient for a population of 5,000,000.

To this plan it is objected that the proposed dam would have to be larger and higher than anything of the kind before attempted, and possibly hazardous, and that the Croton region is becoming so populous that the sources of contamination must soon become so numerous as to seriously injure the quality of the water supply from that valley.

Other plans for the better husbanding of the waters of the Croton region contemplate the damming of the east branch of the Croton, by which means, it is claimed, additional storage can be provided for 4,000,000,000 gallons. The amount of water flowing from the Croton watershed varies from 250,000,000 to 600,000 gallons a day.

To lessen the demand for Croton water, it is proposed to supplement the fresh water supply with salt water drawn from the adjacent rivers, for the use of the fire department, for flushing the streets and water-closets, for water power, and so on. This to be done either by direct pumping under the Holly system, or by a reservoir system. One engineer proposes a huge water tower in the middle part of the city below Central Park, the tower to be 100 feet in diameter and 350 feet high above tide water. On the top of this tower he would place a reservoir holding 2,000,000 gallons, to be pumped up from the river.

These methods would involve a new set of water mains and pipes, to cost, according to the estimates of Mr. Isaac Newton, chief engineer of the Croton aqueduct, more than would be required to furnish the city with the requisite additional supply of fresh water.

Another plan of drawing upon the Hudson River contemplates a pumping station above Poughkeepsie, the water to be brought in an open canal, or through pipes, to this city. This plan would necessitate the lifting of the water at both ends of the aqueduct, which would be expensive, and the propriety of drawing water from a river which has received the sewage of large cities like Troy, Albany, Hudson, and the rest, would be extremely questionable.

Other schemers propose to go still farther up the Hudson, to its upper reaches in the Adirondack region, or to Lake George, a distance of nearly two hundred miles, the water to be conveyed part of the way in an open channel, the rest in closed pipes. The supply is vast, the water of the highest purity, and all the cities along the Hudson River could be provided for in one scheme. The project is a gigantic one, and not likely to be seriously undertaken for many years, if ever.

Two other general sources of fresh water are under consideration. The Housatonic River might be dammed near Falls Village, Connecticut, and the water brought by open canal and tunnel into the Croton valley, a distance of forty miles. This is a project of Mr. Allen Campbell, formerly Commissioner of Public Works. The estimated cost of supplementing the Croton valley supply, in this way, is about $2,000,000. To this would have to be added the cost of a new aqueduct from Croton to the city, which might better be used in bringing to us the Croton water now allowed to run to waste.

The proposed sources west of the Hudson are the Hackensack, Ramapo, and Passaic rivers of New Jersey, and the lakes of Orange and Rockland counties, New York.

To draw from either of the New Jersey rivers would involve the passage of the Hudson, and either tunnels through the Palisades or costly pumping works to carry the water over them. These sources are open to the further objection that all the available water on that side of the Hudson will be needed, sooner or later, for the numerous populous cities growing there.

The lake region of Orange and Rockland counties is scarcely better fitted for the supplying of New York. In that territory are ten lakes, with a storage capacity of 8,500,000,000 gallons, available sites for ten artificial reservoirs, and adjacent lakes and watersheds capable of yielding 100,000,000 gallons a day, 300 feet above the tide level. But they are on the wrong side of the Hudson River.

TORSION TESTS OF CAST STEEL.

Some very careful tests have been recently made, to ascertain the relative resistance to torsion of tool cast steel in its unannealed form, as it comes from the manufacturer and is cut off the bar; in its annealed condition; and as hardened for tool purposes to be used on iron, as taps, reamers, drills, and similar tools that are worked by torsion.

It is not generally supposed that hardening and tempering cast steel increases its torsional resistance: on the contrary it is usually accepted that resistance to torsion depends mainly on toughness—the coherence of fibers when twisted—and that this toughness is much diminished by the process of hardening. But in the tests to which reference has been made, from a number of different manufacturers, the specimens that showed the least torsional strength, when hardened, were yet one and a half times stronger, or resistant to twisting, than unannealed specimens from the same brand. To be more exact, the figures for the unannealed were 5,114, the annealed 5,166, and the hardened 7,596, being an increase in torsional strength of the hardened and tempered specimens over the annealed and the unannealed of more than 33 per cent. Other specimens—those of different brands—showed a still wider difference between unannealed and hardened conditions: as of 5,010 unannealed, and 8,418 hardened; 5,346 against 8,814; 5,124 against 7,920; and of 5,100 against 8,232. These figures may represent pounds, as they actually did in the tests, the pieces tested being of round steel minus five-eighths of an inch diameter, with a distance between shoulders of two and three-eighths inches. The hardened specimens had been hardened and then drawn to a straw color, leaving them as hard as any tempered tool used for working metals, and inferior only to the file, which is not tempered, or drawn, at all.

One of the peculiarities of the tests was that so slight a difference existed between the torsional strength of unannealed steel and that which had been carefully annealed twenty-four hours, the results showing slightly in favor of the specimens tested as cut directly from the bar. The following shows the comparison:

Unannealed..	5,514	5,010	5,346	5,124	5,100
Annealed.....	5,166	4,572	4,864	4,128	4,552

From this it appears that no increase of toughness, or of resistance to torsion, comes from annealing cast steel. But annealing is valuable in rendering the steel more amenable to the action of the cutting tool.

PROGRESS OF MUSIC IN JAPAN.

An interesting reception was given at the New England Conservatory of Music, Boston, Feb. 6, to Prof. Luther Whiting Mason, on his return from a three years' absence in charge of the music in the public schools of the Japanese Empire

At the time of our Centennial Exhibition in 1876, the commissioner from Japan was impressed by the manner in which music was taught in the Boston public schools, and his recommendations led to the calling of Prof. Mason to take charge of the musical instruction given in the schools of the Empire. Prof. Mason had not only to introduce new methods of teaching, but a new order of music, and his success speaks well not only for his methods but for the tolerance and teachableness of the Japanese people, to whom he is about to return. At the reception he explained the development of his method of teaching Japanese children, and exhibited a number of beautiful gifts he had received from the Empress and other people of distinction in Japan. Professor Mason carries back with him as a personal gift to the Empress a handsome crystal vase on which is engraved her portrait. The engraving was done in Munich, and is a fine example of the highest style of the art.

SHALL FAILURE TO DEVELOP FORFEIT PATENT RIGHTS?

It is not an unfrequent occurrence for individuals and corporations having large sums invested in patented machines and processes to take out or purchase rival inventions for the purpose of preventing their development. Where a change of plant would entail a heavy loss, the manufacturer naturally prefers to go on in the old way. He does not want to risk making a bankrupt of himself to introduce improvements for the benefit of others. Accordingly, if he sees where a radical improvement can be made in his work he obtains a patent for it, if he can, and thus forestalls a possible rival. Or, if another man makes an invention which, if put into use, would compel the established manufacturer to adopt it to his temporary or permanent loss, or else retire from the competition, the manufacturer is bound to suppress the rising tyrant if he can. Probably three manufacturers out of every five are owners of patents which they have thus taken out or purchased for their own financial protection.

Occasionally the suppressed inventions are big with promise of benefit to the world, and it is something of a hardship to the public to see the dog-in-the-manger policy pursued with regard to them. Of this nature are some of the undeveloped patents for improvements in steel making controlled by the Bessemer Steel Organization.

To prevent such practices a bill has been prepared to be submitted to Congress, with a view to legislative action to

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break down (in specified cases) the exclusive monopoly enjoyed by patentees. The proposed law provides:

"1. That all associations or combinations, either of natural persons or incorporated companies, formed for the purpose of purchasing a patent or patents for any process of reducing iron ore to steel or iron, with the intention of withholding the use thereof from the public or from individuals or associations desiring to use the same, are hereby declared to be unlawful, and any purchase or attempted purchase of any such patented process by any such association or combination for the purpose or with the intention of preventing the use of the same, shall be construed to be an abandonment to the public at large of all exclusive rights under any such patent.

"2. That where any person, association, or incorporated company shall own, or claim to own, any patented process for reducing iron ore to steel or iron, such owner or claimant is hereby required to issue license to use such patent process to any person, association, or corporation who may desire to use the same in the manufacture of iron or steel. Said license shall be granted upon such terms as may be just and reasonable, to be agreed upon, if practicable, with the owners thereof. If a satisfactory agreement cannot be made, the person or association desiring to use said patented process as above set forth, is thereby authorized to apply to any Circuit Court or District Court of the United States where the owner of said patent or any of them resides, or may be served with process, to have the value of such license ascertained by commissioners to be appointed by said court or by empaneling a jury, as either party may elect, to ascertain the value thereof. Such proceedings shall, as near as practicable, conform to the proceedings for the appropriation of private property for public use as are prescribed by the laws of the State wherein the proceedings hereby authorized shall take place.

"When the value of such license thus applied for shall have been ascertained, as herein provided, the court in which such proceedings are conducted shall enter a decree or judgment setting forth the same, and shall direct the manner in which payment for said license shall be made, and shall make such further order in the proceedings as shall duly protect the rights of all the parties thereto. As soon as the party applying for said license shall comply with the orders of the court, he shall be entitled to use said patent process in accordance with said judgment or decree.

"3. Jurisdiction to conduct the foregoing proceedings is hereby conferred upon all circuit and district courts of the United States."

This is a new phase of an old scheme, and, as usual, one palpable, though comparatively small, wrong is made a pretext for legislative action calculated to introduce or open the door for vastly greater wrongs.

Grant that it is an injury to the community to delay or willfully prevent the development of a new and useful invention. Grant that the proposed law would tend to prevent such delays. Has Congress the right to prevent such wrongs in the manner prescribed? Would it be good policy to remedy the evil in that way, the right being clear?

While Congress is constitutionally authorized to shorten or lengthen the lifetime of patents for invention, or to abolish the patent system entirely, the Constitution gives it no authority to provide for the issuing of letters patent for other than the exclusive right to make, vend, and use the thing or process patented. If Congress can make void one class of legally-issued patents for the specified reason, why not all patents that may be withheld from use? If Congress can compel one class of patentees to issue licenses, why not all patentees? By what authority is Congress to enact a special law, a law applicable only to makers of iron and steel?

The trouble with those who desire legislation of this sort arises from the narrowness of their view. Their selfishness is too short-sighted to be wise.

It is obviously a misfortune to have a useful invention withheld for seventeen years; but the misfortune would be vastly greater if the invention were to be absolutely suppressed, kept secret by the inventor to die with him; and greater still if inventors were debarred or discouraged, as they would be under such a law, from trying to make "new and useful inventions."

Seventeen years is but a little time compared with the life of the nation. It is unquestionably desirable that all novel ideas shall be immediately worked out as factors of industrial progress; but the country can better afford to wait a few years for their development than to hurry them by means calculated to hazard their very existence.

The patent system is designed not for the rewarding of inventors, but for the advancement of the useful arts and sciences. That advancement is to be secured primarily by the immediate registration and publication of novel ideas to serve immediately or remotely for the instruction and guidance of all workers in arts to which the new ideas are helpful; secondarily, by giving the patentee a temporary control of his invention, to incite him to make greater efforts and to justify larger expenditures to hasten the practical development of his invention. If the latter incentive fails, and the invention remains unimproved for the full term of the patent, the public is still the gainer. The disadvantages attending the occasional willful holding of a patented invention in abeyance are vastly more than overbalanced by the advantages which flow from the prompt admission of new ideas into the world of creative thought; and ultimately the public enjoys the full and free use of the invention specified. Further, the disadvantages chargeable to patents temporarily withheld from use are out of comparison with those which would certainly result from an invasion of the patentee's exclusive control of his invention during the lifetime of his patent. The proposed law would at once destroy a large part of the incentive to invention which the patent laws now hold out, and at the same time a large part of the patentee's inducement to spend the money necessary to develop and perfect his invention. Under a license system the inventor's rivals would share all the advantages of his success without having shared any of the preliminary risks and expenditures.

THE ZEBRA WOLF.

BY DR. G. A. STOCKWELL.

Of all the mammalia, none possess so much that is interesting and peculiar as the so-called marsupials or pouched animals; and excepting the opossums, strange to say, this class is confined exclusively to Australia, Tasmania, and the isles of the Papuan group. With kangaroos, petauristes, wombats, and "ursine devils," we are more or less familiar, through the mediumship of zoological gardens, traveling menageries, and the writings of accredited travelers; but the Tasmanian or zebra wolf is almost unknown, and so far as the writer has been able to discover has been exhibited in captivity only in a single instance. Two specimens were obtained by the Royal Zoological Gardens of London, England, but quickly died, pining away through confinement, and, perhaps, disease brought on by a two months' sea voyage and change in climate.

The peculiar modification of the nutrient organs that has given rise to the title *marsupial* (from marsupium, a pouch), is the peculiar sac provided the females for the protection of their immature young. This is developed in a greater or less degree in each species, but may easily be studied in our common or Virginian opossum, whose chief place in the world seems to be to provide Sambo or Cuffy the material for a Christmas dinner, peculiarly his own. Mind you, I do not decry its edible qualities, but would merely suggest its being far more interesting under the dissecting knife than at the festal board. Examination reveals the pouch to be supported by two elongated bones that project, or are rather prolonged, from the crest of the hip, and which lie just beneath the skin and in the same general plane with the back; and within this pouch are concealed the breasts or mammæ.

When the young marsupial is first ushered into the world it is a tiny and helpless being, of such minute size as to be out of all proportion to its parent; even the young of the bush kangaroo, an animal nearly or quite as large as our common deer, being scarcely larger than newly born rats; and they are blind, naked, and even incapable of voluntary movement. As quickly as born the youngling is seized by the lips of the mother and at once conveyed to the interior of her pouch, meantime held open for its reception by her forepaws, and placed upon the breast, to which it at once clings instinctively, not again releasing its hold until of considerable size and capable of voluntary exertion—a matter of weeks, sometimes months. Once so placed, the little one demands little attention, and to all intents and purposes is as much a part of its parent as during the period of gestation. It would seem to be incapable of again letting go its hold, as the muscles of the mouth at once contract so strongly about the bulbous portion of the nipple that even in death separation is effected only with some difficulty.

I have said that the wee marsupial is incapable of voluntary movement. This is so much the case that it has not the power to draw the nourishment from the maternal fount, or even swallow when once its mouth is filled; consequently, the mother is provided with a supernumerary muscle that, passing over the glands, compresses them at her will, forcing the milk directly into the little one's stomach, and at this time, too, Nature has wisely provided to prevent strangulation by elongating the larynx or windpipe to the nasal cavity, so that it is joined to and forms at once a part of the nostrils themselves, thus allowing breathing and feeding to go on simultaneously. When able to feed itself, this prolongation is gradually absorbed. As the youngster now approaches his more perfect form, his eyes are loosened from their bands and the tender skin is covered with a coat of hair, and he begins to act more like the offspring of other animals. Now his mouth is under control, and he can release himself and feed at will; and in the spirit of curiosity frequently puts his head out from the sheltering pannier to survey the surrounding world; and finally ventures therefrom in search of more solid food than that to which he has been accustomed, though still retaining the pouch as refuge when fatigued or shelter when threatened with danger. With some animals it is no uncommon affair to find young of different ages occupying the pouch at the same time—some almost ready to be emancipated, the others weak and imperfect creatures of recent birth.

It is strange that all the mammals of Australasia are marsupials, from the pygmy pitaroo and the haunting phalangers up to the giant kangaroo. To the same class belongs the zebra or Tasmanian wolf, an animal far the most formidable, as it certainly is the most savage of indigenous quadrupeds. Too feeble and cowardly to successfully attack man, it is, nevertheless a terrible pest, committing serious ravages among all other creatures, irrespective of form or habits of life, the wombat alone excepted. No matter how hungry he may be, he will not touch this fat and sluggish marsupial, though, as it subsists on fruit alone, it would seem to be most edible. By no means swift or agile, and sneaking and crawling in habits, the zebra wolf nevertheless manages to kill the kangaroo in defiance of its boasted leaping powers and powerful claws of its hind feet, and to secure the ornithorynchus, or common duck bill, in spite of its subterranean burrows and natatory habits. It does not even hesitate to seize upon and devour the prickly echidna, a much more formidable mouthful than any porcupine; and even prowls the sea shore searching for food among the heterogeneous masses flung up by the waves, renewed or added to by each succeeding tide. Shore crabs, which dot the beach in numbers after every flood, are caught with no little dexterity, and mussels and limpets are readily detached from the rocks, while the carcass of a seal or fish, or the body of a wild fowl, no matter how oily or fishy, serves as a tidbit. As quickly, however, had civilized man taken up his abode in Tasmania, the wolf became an object of dread, as poultry and domestic animals were never safe from its attacks. The sheep especially became the objects of the settler's anxious care, for no sooner were they introduced than a most unmistakable appetite was developed for mutton, seemingly preferring the flesh of that useful and easily mastered animal to that of any kangaroo, however venison-like, or bandicoot, howsoever savory.

In size this wolf approaches a large setter or Newfoundland dog, averaging perhaps a little more than five feet in length from snout to tip of tail, the latter appendage claiming a little more than one-third of the measurement; but specimens are sometimes killed that exceed this by half a yard; at the shoulders it is some twenty or twenty-two inches in height. The feet are protected on their bottoms by rough pads, and the toes, of which there are five on the fore feet and but four on the hinder ones, are all armed with short, straight, powerful claws. The head is very like that of a dog, the muzzle being long, narrow, and pointed, with a white, grizzled upper lip, sparsely sprinkled with a few black hairs, a few of which also ornament the cheeks and ridges above the eyes. The ears are sharp, pointed, erect, very broad at their base, and covered with hair both without and within; while the eyes are sharp, full, and black, and protected with a false or nictitating membrane like the owl, to shut out the unwelcome light of the sun, for it is nocturnal in habits, rarely venturing out during the day, but hiding in the recesses of the rocks among which it chiefly dwells. Of a general grayish-brown hue, mixed with yellow, banded above with a series of black stripes, which beginning at the shoulder diversifies the whole back to the tail, gradually increasing in length on the haunches and prolonged on to the thighs, it is this marking which gives rise to its many names of zebra, hyena, and tiger wolf.

There are several reasons why the animal is seldom exhibited in captivity. First, they are exceedingly sly and wary, and are hidden in dens most difficult of access, where daylight seldom penetrates, and where the female brings forth her young, four at a litter, remaining with them and supplied with food by her spouse until they are able to care for themselves. Second, when brought to bay by dogs, they fight with incredible fury, and yield only when torn in pieces. Again, the hatred of the settlers is so intense, that scarce any reward is sufficient to purchase the life of a captured animal.

Formerly they were quite prevalent in Tasmania; they would seem never to have been known on the continent of Australia, but by degrees the guns, traps, and poisoned baits of the settlers have prevailed, stimulated perhaps by the bounties offered; and the war of extermination has waged so fiercely, that the wolves have been driven from the haunts that once knew them, the few survivors being confined to the wildest and most inaccessible regions of the Humboldt Mountains and Hampshire Hills.

Preservation of Butter.

Dr. W. Hagemann has observed that cow butter contains 0·5 to 0·6 per cent of milk sugar, which under the influence of bacteria is transformed into lactic acid, and this liberates from the glycerides the acid, containing less carbon. It is obvious from this that summer butter becomes rancid more rapidly and strongly than winter butter, and that for the preservation of butter two methods may be adopted, viz., either the lower fat acids are removed by soda solution, as proposed by Adolf Mayer and Dr. Clausnitzer, or else the milk-sugar must be removed, or its decomposition prevented by suppressing the vegetation of the bacteria.—*Chem. Ztg.*

Treatment of Bulbs.

An ounce of nitrate of soda dissolved in four gallons of water is said to be a quick and good stimulant for bulbs to be applied twice a week after the pots are filled with roots and the flower spikes are fairly visible. A large handful of soot, or about a pint, tied up in a piece of old canvas and immersed in the same quantity of water for a day or two, will give you a safe and excellent stimulant; also good and safe is a quarter of a pound of fresh cow-dung mixed in a large garden pot of water and used as required. Any of these stimulants will do good, as the whole of them applied alternately will benefit bulbs that need more sustenance than the soil affords.

Photograph of Comet's Tail and Stars.

Dr. Gill, at the Cape of Good Hope, succeeded in photographing the comet's tail and with it fifty stars that were seen through the tail. The plate was exposed 140 minutes, and was kept up to the motion of the earth by clockwork.

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NEW KEY FASTENER.

The engraving shows a novel lock escutcheon, by which the key may be held and securely fastened in the lock, and by which the keyhole may be closed when the key is not in the lock. A device is provided for preventing the escutcheon from being operated from the opposite or under side by a knife or sharp pointed instrument.

The escutcheon consists of two plates of circular form, one plate being fastened by screws to the door, and having in it a keyhole and a curved slot, shown by the broken lines. The second or outer plate is pivoted to the inner plate, and has a keyhole with a straight slot opening out of it. A stud passes through a slot in the inner plate and limits the motion of the outer plate, and a knob is provided by which the plate may be moved, so that the keyholes in the two plates will correspond. The key is inserted and turned, throwing the bolt until the flat part of the handle of the key stands in the proper position to be received by the slot in the outer plate, when this plate is moved back to correspond with the under plate, with the key inclosed in and held from turning by the slot.

When the two plates coincide, holding the key in the slot, it would be possible to enter a knife or pointed instrument through the opposite keyhole, and by pressing the point into the under surface of the movable plate to move it back, causing the keyholes to correspond, when the key may be turned or pushed out. In order to prevent this, notches are formed at the inner end and on the sides of the curved slot in the fixed plate, and two wings are formed on the opposite sides of the stud or pin projecting from the movable plate, so they coincide with notches in the fixed plate when the key is locked in; and any pressure against the under side of the plate will push the plate so that the wing on the end of the stud will enter the notches, effectually preventing the plate from being moved in the manner described. This device answers the purpose of an extra lock or bolt, and is very easily applied to a door, and cannot get out of order. It effectually prevents the key from being turned with forceps or pushed out from the opposite side. It makes the cheapest lock perfectly safe, and it presents a neat appearance on the door. It can be used with either flat or round keys.

This invention has been patented by Mr. Edward K. Tolman, of 59 Pleasant Street, Worcester, Mass., who may be addressed for further information.

Vegetable Substitute for Rennet.

BY SIR J. D. HOOKER.

Mr. Stormont, Superintendent of the Government Farm, Khandesh, reported May 10, 1880: "Cheese making is a branch of agricultural industry altogether unknown in this district, and but imperfectly understood in any part of India; yet there seems no reason why it should not be successfully practiced."

Commissioner E. P. Robertson minuted upon this, June 10, "Cheese to be salable among the natives of this country should be made with some vegetable rennet. Natives would not touch cheese made with ordinary rennet, and I am convinced that good cheese cannot be without the use of some rennet. If a good vegetable rennet could be procured, the curd cheeses could be made; they would be cheap, and ryots would soon find a ready sale for them."

These facts having attracted my attention, I consulted Mr. A. H. Church, formerly Professor of Chemistry in the Royal Agricultural College, Cirencester, but who has taken up his residence at Kew, and is now Professor of Chemistry to the Royal Academy. This gentleman very kindly made some experiments on curdling milk, with calcium chloride and with vegetable acids. He arrived at the conclusion, however, that though in the laboratory good results could be obtained, they depended too closely on careful attention to the conditions of the process to afford a workable method for everyday use in India. Meanwhile, I had turned my attention to some suitable vegetable "rennet." Surgeon-Major Aitchison, while engaged at Kew, in working up his Afghan collections, under instructions from the Government of India, suggested a well known northwest Indian plant (*Puneeria coagulans*) as possessing the desired qualities.

The plant in question is one of the best known plants in Scinde, Beloochistan, and Afghanistan. "It bears the name of Puneer-bund (cheese maker), from its being used by the Beloochees and Afghans in making cheese (puneer), as a substitute for rennet."

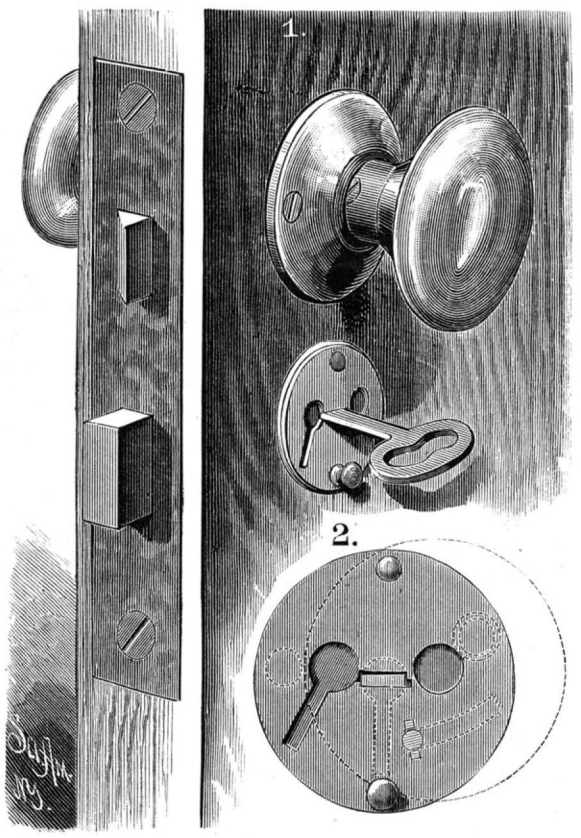
I communicated this information to the India Office. As will be seen from the following extract from Mr. Stormont's report for 1881, the suggestion was immediately acted upon with very gratifying success:

"During the year a good deal of attention has been devoted to dairy experiments, especially the making of cheese after the practice of Italy and Switzerland. The Commissioner, C. D., pointed out that, before cheese making can ever become an industry of the ryots, some vegetable substance must necessarily be found to take the place of the animal rennet used in European countries.

"In connection with this difficulty, Surgeon-Major Aitchison brought to the notice of the authorities at Kew that the fruit of *Puneeria coagulans*, a shrub common in Afghanistan and Northern India, possesses the property of coagulating milk.

"A quantity of the dried capsules of this plant was accordingly obtained, and part of it tried here, and found to be most suitable for the purpose. Being a member of the poisonous nightshade family, its safety was in the first place carefully and gradually tested. It has been ascertained that an ounce of the pounded capsules in a quart of water is a very suitable strength for use; a tablespoonful of this decoction coagulates a gallon of warm milk in about half an hour. Seeds of the plant sown have germinated freely, and their further progress will be specially reported upon."

The anxiety as to the botanical position of *Puneeria* among the *Solanaceæ* has, I think, no solid foundation. The genus *Puneeria* is now reduced by botanists to *Withania*. This is a member of the tribe *Solaneæ*, which appears to be generally free from the poisonous principles so characteristic of *Atropeæ* and *Hyoscyameæ*. It abounds, in fact, in plants producing fruits which daily experience shows to be innocuous, such as the tomato, aubergine, capsicum, *Cyphomandra*, and cape gooseberry.—*Kew Report.*

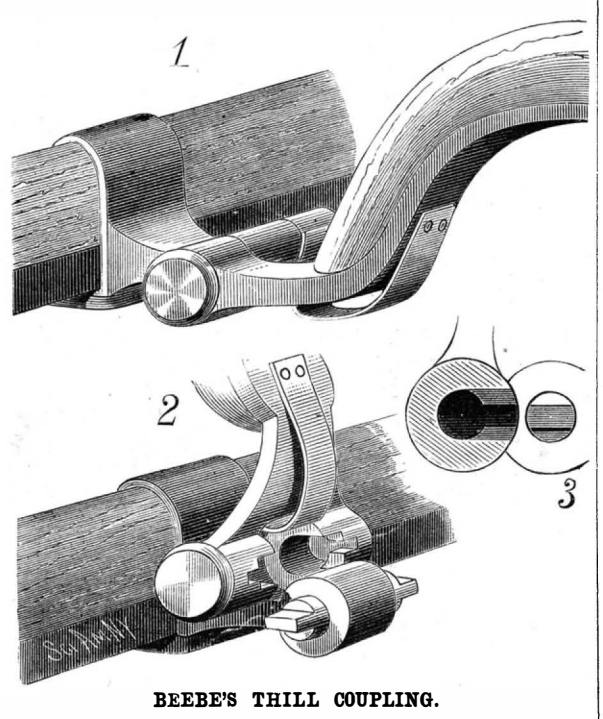


NEW KEY FASTENER.

IMPROVED THILL COUPLING.

The engraving represents an improved coupling for the thills of carriages and wagons, recently patented by Mr. G. W. Beebe, of Swanton, Vt. This device is simpler than the ordinary coupling, while it is perfectly secure against accidental uncoupling. It consists of two parts, one attached to the thill, the other to the axle.

Fig. 1 shows the coupling in condition for use; Fig. 2 shows it with the two parts separated; Fig. 3 is a sectional view, showing the end of the pin and the recess in the fork attached to the thill. The part of the coupling carried by the axle consists of a clip secured to the axle in the usual way, and having on the front side an arm supporting a short cylinder having at each end a cylindrical stud with a flattened end. Each branch of the fork attached to the end of the thill has a cylindrical cavity opening inward and provided with a side opening, which will admit the stud at the end of the short cylinder carried by the clip, when the thill is in a vertical position. When the thill is turned down into a horizontal position for use, the flat portion of the stud will be arranged transversely relative to the narrower portion of the side opening in the end of the fork.



BEEBE'S THILL COUPLING.

It will be seen that with this arrangement it is impossible to remove the thill except by bringing it into a vertical position and moving it backward, as shown in Fig. 2. A spring riveted to the fork prevents rattling by pressing against the cylinder carried by the axle clip.

Further information in regard to this useful invention may be obtained by addressing the inventor as above.

The Yankee in the South.

The impression still obtains that the Southern people cherish such a deadly hatred to Yankees that they will neither smell, taste, touch, nor handle anything contaminated by Yankee hands. This is a most egregious error. The Southern people love the Yankee, and they show this affection in a thousand different ways. When they retire at night, they unbutton Yankee buttons to Yankee made coats, waistcoats, pantaloons, shirts, and drawers. They pull off Yankee boots with Yankee boot jacks and divest their feet of Yankee socks. They march to Yankee bedsteads, turn down Yankee coverlets, Yankee blankets, prostrate themselves on Yankee mattresses, and lay their heads upon Yankee pillows. The bedbugs are the only things not made by Yankee hands and imported from the land of the Yankees. On rising in the morning we tread Yankee carpets, stumble over Yankee chairs and sofas, build a fire with Yankee coal taken from Yankee scuttles, in Yankee grates, catch the ashes in Yankee pans, and use Yankee pokers, Yankee shovels, and tongs. We repair to Yankee washstands, pour water from Yankee pitchers into Yankee bowls, and wash with Yankee soap; then use Yankee towels and Yankee tooth brushes. Next we march to a Yankee bureau, stand before a Yankee glass, and use Yankee combs, Yankee brushes, Yankee powder, Yankee cologne in Yankee bottles. We sit down in a Yankee chair to a Yankee table, covered with Yankee cloth, Yankee knives and forks, Yankee dishes, and fed upon Yankee food. We call for Yankee toothpicks, seize Yankee hats from Yankee racks, turn the key to a Yankee lock, open a Yankee door, enter a Yankee buggy, seize the Yankee reins to a Yankee harness, and repair to our place of business, and spend the day in trading on Yankee industry. The South is rich in resources, but our people are so fond of the Yankees that they lavish their wealth upon Yankee enterprise.—*Memphis Appeal.*

Cure for "Spinning."

M. Poisot lately communicated to the *Société de l'Industrie Minérale de Saint Etienne* some useful information as to the means for preventing the "spinning" of locomotive wheels in the Mazenay mines, no more fuel being now employed for hauling out 100 tons than for 80 formerly. He observes that the ventilation is effected by diffusion, and there is constantly in the rolley way a tolerably thick smoke, which with condensed steam from the engine and the dampness of the workings causes the rails to be slippery. The consequence is that every time they tried to ascend the gradient of 1 in 66 with a full train, they could only get up half of it, about 180 meters (590 feet) without the wheels beginning to spin; and during the rest of the rise, notwithstanding the use of fine and dry sand, this difficulty frequently began again, so that they lost pressure to such an extent that they were obliged to stop to make steam. This difficulty caused great consumption of fuel, excessive wear of the working parts of the engine, and a rapid destruction of the rails. About two months ago the joint of one of the cylinder cocks leaked, and a jet of steam escaping from it was directed on to the rail, when the train took the gradient without the engine once spinning. For two days they worked without making the repair, and the locomotive drew all the trains without the slightest stoppage. In consequence of this experience they altered the cylinder cocks so as to make them discharge directly on to the rails, and when they get to the gradient the cocks are slightly opened, so that they ascend it without difficulty.

The Inventor of the Incandescent Electric Light.

Prof. W. Mattieu Williams, writing to *Nature*, says: In the "Notes" of *Nature*, vol. xxvii., p. 209, M. De Chagny is described as "the first electrician who attempted to manufacture incandescent lamps *in vacuo*, about twenty years ago." This invention and its successful practical application (irrespective of cost) was made by a young American, Mr. Starr, and patented by King in 1845. A short stick of gas-retort carbon was used, and the vacuum obtained by connecting one end of this with a wire sealed through the top of a barometer tube blown out at the upper part, and the other end with a wire dipping into the mercury. The tube was about thirty-six inches long, and thus the enlarged upper portion became a Torricellian vacuum when the tube was filled and inverted. I had a share of one eighth in the venture, assisted in making the apparatus and some of the experiments, and after the death of Mr. Starr all the apparatus were assigned to me. I showed this light (in the original lamp) publicly many times at the Midland Institute, Birmingham, and on two occasions in the Town Hall, all of them more than twenty years ago. The light was far more brilliant, and the carbon-stick more durable, than the flimsy threads of the incandescent lamps now in use. It was abandoned solely on account of the cost of supplying the power. As a steady, reliable, and beautiful light, its success was complete. In "A Contribution to the History of Electric Lighting," published in the *Journal of Science*, November 5, 1879, and reprinted lately in my "Science in Short Chapters," may be found further particulars concerning this invention and its inventor.

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How to Help a Man Who Swears Off.

A large audience assembled at Franklin Institute Hall, Philadelphia, recently to hear the last lecture of the New Century Course for Women. Suggestions contributed by Dr. Joseph Parrish, of New Jersey, Dr. R. P. Harris, of the Franklin Home, Dr. Jos. Klapp, of the Washingtonian Home, Dr. T. D. Crothers, of the Hospital for Inebriates in Hartford, Conn., Dr. Chas. Mohr, Secretary of the Pennsylvania Homœopathic State Society, and many others, were read.

Mr. C. Gibbons, Superintendent of the Franklin Home, made an earnest appeal to women for patience with the men whose weakness has tried them so sorely, and who suffer so deeply themselves in their efforts to reform. Very interesting addresses followed from Mr. S. P. Godwin, founder of the home, and the Rev. Chas. G. Ames. All agreed that the safest of all ways to stop drinking is to stop short off from all stimulation whatever, hot drinks, cold drinks, bitters, and all the list.

The Philadelphia *Ledger* sets down some of the advice given for the benefit of those to whom such a break would be an impossibility. For such let the house mother always have on hand something hot, or tonic, or refreshing, to tide over for the hour the agonizing demand of the body for stimulation. Hot drinks—coffee, sometimes tea, cocoa, either ground or in the form of shells or cracked cocoa. This is nutritious as well as satisfying. Hot broth, beef tea, or beef essence can be bought, but are far better made at home; hot milk, ginger tea, cayenne pepper tea, and an article called tabasco, which is hotter than ordinary cayenne. Aerated drinks—lemon soda, zoedone, and ginger ale can be kept in the house, and are harmless, the tang being given by fixed air; the home-made beers, on the contrary, are treacherous, the life depending directly on fermentation. Refreshing drinks are cold milk, buttermilk, whey, drinks from lemon and other acid fruits, Horsford's acid phospliate, and what is just as effectual and much cheaper, dilute phosphoric acid. A few drops in water, sweetened, makes a pleasant drink, and ten cents' worth will last for months. Oatmeal water, just a handful in a pitcher of water. This is both refreshing and strengthening, especially in summer.

In the Baldwin locomotive shops, where about 5,000 men are employed, this is kept on hand in large quantities, and, strange to say, even drinking men grow fond of it. They say that when they drink it they don't seem to want their beer. Juicy fruits—apples, oranges, melons, etc. The surest way to bring up children not to care for alcohol is to accustom them early to liking all sorts of fruit. The lecturer spoke in the strongest terms of the misery caused by physicians by the reckless prescribing of alcoholic stimulants to patients, without a word of inquiry as to the habits or the inherited tendencies of the individual.

A New Test for Living Germs in Water.

Many analysts, says the *Brewer's Guardian*, are in the habit of testing the organic purity of a water by dissolving a little sugar in it; if the germs of any living organisms are present, the water will, after being kept in a warm place for about twenty-four hours, become cloudy, and sometimes quite milky or opaque, owing to the rapid development of fungoid organisms, resulting from the growth of the germs in a suitable nutritive medium. The test is a valuable one, but requires to be used with caution. It is well to remark, however, that some chemists believe that the growth of the fungoid organisms is dependent upon the presence of phosphates rather than upon any organic impurities, and that it is possible the germs may be derived from the air, and not from the water itself. Those who have experimented on the subject cannot have failed to observe how very varied is the behavior of different waters when treated with sugar.

Recently Dr. Smith, of Manchester, has pointed out that gelatine is most valuable in detecting organic vitality in waters. About 2½ per cent of gelatine well heated in a little water is mixed with the water to be tested, and the mixture forms a transparent mass, which is not movable like the water itself. When soluble or unobserved matter develops from the organic matter of the waters, and makes itself visible in a solid and insoluble form, it does not fall to the bottom, but each active point shows around it the sphere of its activity, and that sphere is observed and remains long. The gelatine preserves the whole action, so far as the more striking results are concerned, and keeps a record for a time, both of the quality and intensity of life in the liquid. Dr. Smith speaks of the more striking effects, which are clear and abundant, every little center of life making itself apparent to the eye, and sometimes expanding its influence to reach both sides of the tube.

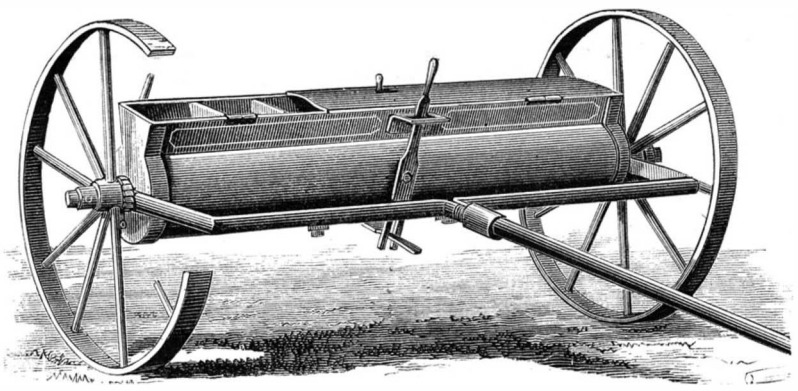
It seems to him now essential that all chemical examination of water should be supplemented by an inquiry into the comparative activity of the living organisms.

A New Moxa.

Under the name of *crayon-feu*, Dr. Moses describes a preparation made as follows: Charcoal powder, 30 grammes; potassium nitrate, 4 grammes; powdered iron, 5 grammes; benzoin, 1 gramme; the whole to be made up with some active substance into forty crayons. He so obtains a hard preparation, which is easily inflamed by a match, and which he proposes for the cauterization of poisoned wounds and when the actual cautery is required.—*Medical News; Gaz. Hebdomadaire.*

IMPROVED SEED SOWER.

This is a machine for sowing tobacco seed, cabbage seed, turnip seed, and other small seeds, accurately and expeditiously. The shell of the seed box is cylindrical, with a vertical upper part provided with a cover. The hubs of the drive wheels are connected with the axle by set screws, so that they may be readily detached when required. The axle passes through and revolves in bearings in the ends of the cylindrical part of the shell.



IMPROVED SEED SOWER.

To the axle within the shell are attached a number of disks, to the edges of which are attached rods extending throughout the length of the seed box. These disks and rods form a stirring reel to agitate the seeds, so that they will readily pass out through the discharge apertures in the bottom of the seed box. The disks also serve as partitions to separate the seed box into compartments, to prevent all the seed from settling toward one end of the seed box should the seed box be inclined toward either end by one of the wheels passing over a clod or other obstruction.

In the bottom of the seed box are formed two or more rows of discharge apertures of unequal size, so that either row of apertures can be used, as the size of the seeds to be sown may require.

A curved plate fits upon the outer surface of the cylindrical bottom of the seed box, and is held against the bottom of the said seed box by bands passing around the lower part of the shell, and secured at their ends to the front and rear sides of the shell. With this construction the valve plate can be adjusted by sliding the plate laterally between the shell and bands.

A plate which projects downward and is curved to the rearward, is attached to the seed box and serves as a guard to prevent the discharge openings from becoming clogged by the contact of soil with the bottom of the seed box.

The principal advantages possessed by this machine are simplicity, lightness, durability, and cheapness. It is adapted to all kinds of seeds, is reliable, working equally well on rough and smooth land, and is capable of being used when drills are unavailable. We understand it has been approved by our best farmers.

This invention has been patented by Mr. John F. Heady, of Ghent, Ky.

THE facetious Mark Twain says there is something very fascinating about science—it gives you such wholesale returns of conjecture for such trifling investments of fact.

Floral Decorations.

Ornamental grasses impart to an arrangement a lightness and distinctive character which fern fronds, handsome as they are, fail to give. Moreover, it is difficult to keep up the needful amount of cut ferns without disfiguring the plants; therefore, we should grow ornamental grasses for the purpose, thus sparing many fern fronds. Most of the useful sorts are easily grown from seeds. We sow them in March in the open border in well prepared soil—the earlier in the month the better, if the weather is favorable. We have found the following six kinds to be among the most useful, viz., Agrostis nebulosa, and pulchella.

These come into flower early, and are about the very lightest that can be grown; they are also often sown in pots, and in this manner are useful for furnishing purposes. Briza maxima and gracilis are two of the best of the quaking grasses. We find the former to be especially valuable, and to arrange well with water lilies and similar subjects. This sort is also one of the best for cutting and drying for later use; if cut while the deep green tint is in it, it retains its color better than if left till it has assumed a brownish tinge.

Lagurus ovatus (the Turk's head grass) is one of the most distinct kinds, as well as one of the best for keeping purposes if treated as just advised in the case of the Briza. For bold arrangements in association with large flowers this is an excellent kind. Another valuable grass is Eragrostis elegans; this is a later kind than those previously named, and comes in useful for cut purposes up to the time when the early frosts spoil its color. It is a somewhat stronger sort than the others; when well grown it attains a height of from 2 feet to 2½ feet high. It should therefore be allowed more room than the others in which to develop itself. The following sorts are all useful and distinct, viz, Anthoxanthum gracile, Brizopyrum siculum, Bromus brizæformis and giganteus, Hordeum jubatum, and Paspalum elegans.

Two new kinds have recently been brought forward, viz., Briza spicata and Bromus patulus nanus, both of which will doubtless prove useful. These grasses, taken collectively, are about the best that can be annually raised from seed Stipa pennata and elegantissima may be increased by division, perhaps, with more certain results than from seeds. These ornamental grasses are all valuable in their seasons, and for preserving for use afterward, not, however, after they have been disfigured by drying. When those raised from seed are well above the soil, it will be well to thin out any kind that has come up too thickly. This will throw more stamina into those that are left, rendering them more durable.

The following annuals are all useful associated with grasses, viz., Campanula loreyi and its white variety. Catananche cœrulea, sweet sultan (yellow), Rhodanthes, Linum grandiflorum coccineum, the Corn Flowers in various colors, dwarf poppies, single dahlias, which have a future before them, and last, but not least, Gypsophila elegans and its variety rosea. Many more annuals might be named, but these are among the best for decorative arrangements and for using in conjunction with grasses. One of the hardy perennials that may be raised from seed is Chelone barbata coccinea; this when in flower yields good spikes for trumpet vases.—*The Garden.*

IMPROVED SEED SOWER.

The Great Wall of China.

An American engineer who, being engaged in the construction of a railway in China, has had unusually favorable opportunities of examining the famous Great Wall, built to obstruct the incursions of the Tartars, gives the following account of this wonderful work: The wall is 1,728 miles long, 18 feet wide, and 15 feet thick at the top. The foundation throughout is of solid granite, the remainder of compact masonry. At intervals of between two hundred and three hundred yards towers rise up twenty-five to forty feet high, and twenty-four feet in diameter. On the top of the wall, and on both sides of it, are masonry parapets, to enable the defenders to pass unseen from one tower to another. The wall itself is carried from point to point in a perfectly straight line, across valleys and plains and over hills, without the slightest regard to the configuration of the ground; sometimes plunging down into abysses a thousand feet deep. Brooks and rivers are bridged over by the wall, while on both banks of larger streams strong flanking towers are placed.

The Unused Water Power of North Carolina.

Recently, in Congress, Senator Vance, of North Carolina read from a report of the late Professor Kerr, geologist of that State, an estimate of the unused water power of the North Carolina rivers. The main streams have an aggregate length of 3,300 miles, with an average fall of ten feet to the mile, giving a horse power of 3,300,000. The numerous tributaries are not included in this estimate. The wasted water power of the State rivals the estimated engine power—stationary and locomotive—of Great Britain.

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MACHINE FOR EXCAVATING THE CHANNEL TUNNEL.

(*Continued from first page.*)

pounds per square inch, a pressure commonly employed. The cutting machinery at the face will be driven by an ordinary hydraulic motor direct without the intervention of gearing. The *débris* of chalk cut down will be taken up by a series of cups and thrown into a chute, at the top of which the waste water from the hydraulic motors is conducted. The water flowing down carries with it the *débris* of chalk, and both pass into an ordinary cylindrical revolving drum, where it is reduced to sludge. The quantity of water used by the hydraulic motors will be so calculated that it will amount to about three times the quantity of chalk *débris* by weight. When mixed with the water in the revolving drum, the very small *débris* almost instantly dissolves, and the result is a cream or sludge, which is taken up by ordinary pumps, worked by hydraulic motors, and forced into the main outlet pipe to the bottom of the shaft, or direct up the shaft to the sea if required. The pumps are placed upon the main frame of the boring machine, and driven by high pressure water taken from the main inlet pipe.

The cream is forced by the pumps through the excavated portion of the tunnel to the bottom of the shaft, and thence may be raised by pumps or other suitable means to the top and discharged into the sea, or disposed of in other ways.

It will now be perceived that the space lying between the boring machinery and up to the top of the shaft is left entirely free, excepting so small a portion of it as is occupied by the two pipes—the high pressure water inlet pipe and the cream outlet pipe.

The operation of lining the tunnel may therefore be carried on with the greatest facility, there being no traffic upon the rails, no hoisting up or lowering in the shaft except that necessary to transport the workmen and the building materials for lining the tunnel, amounting to only one-quarter that required on the ordinary system, or in other words, three-quarters of the whole weight to be disposed of is carried through pipes instead of by locomotives and trucks.

The cutting machine is of a most simple construction, designed for the purpose of excavating the chalk. It consists of a number of small disks attached to a large boring head made to revolve at any given speed. The disks turn freely on their spindles, and as they cut only a width about one-quarter of their diameter, they turn in an opposite direction to that in which the large disk is turning, and thus act by rolling into the chalk and changing the cutting edge continually, whereby the wear and tear of the edges is reduced to a minimum; at the same time the cutting edges do not require sharpening, a most material feature.

By trials I have ascertained that two horse power per cubic yard of chalk excavated would be more than ample; and if in piercing a tunnel 36 feet in diameter 170 cubic yards of chalk will have to be cut down, 340 horse power will have to be provided for this part of the work.

In the real machine the pressure of the incoming water upon the area of the telescopic joint, in the one case, and the back pressure of the cream, forced toward the exit, on the other, will push the machine forward automatically, and it becomes necessary to provide an arrangement to control this speed and allow the machine to advance only at a certain desired rate forward. There are various simple means of effecting this object.

To cut a clear face 36 feet in diameter will require seventy-two 12 inch cutting disks upon the arms or cross-beam—each cutter in one revolution of the machine taking off a concentric ring 3 inches in width and one-sixteenth of an inch thick—supposing the cross beam or head to turn at the rate of ten revolutions per minute. This would give the cutter on the extreme outside a periphery speed of 1,130 feet per minute, which has been found to be well within practical limits. It will be understood that the cutters turn at different speeds, those near the outer periphery doing considerably more work than those near the center, the revolving cutters being equally effective at all speeds.

The apparatus for the reduction of the chalk *débris* to sludge or cream is a plain cylindrical drum. One face of this drum is made of a strong wire grating except in the center, where a hole is left. Through this central aperture the *débris* of chalk and the water in whatever quantities required are introduced, and as the drum revolves, the particles of chalk, saturated and softened by contact with the water, are quickly dissolved, and a cream or sludge of more or less consistency is produced, which escapes through the meshes of the wire grating and collects in a reservoir, whence it is taken up by a pump and forced to the place where required.

As a matter of fact, two drums, 7 feet in diameter and 7 feet in length, will be amply sufficient for the purpose with 85 horse power.

The conveyance of the cream through ten miles of pipe on a level, back to the bottom of the shaft, will be done by a 12 inch main pipe with a pressure of 700 pounds per square inch; the water passing through this pipe at a velocity of 6½ miles per hour, or 9·5 feet per second. The total horse power developed by this quantity of water amounts to 1,377 horse power at our disposal at the face. The sludge being composed of chalk, 76 cubic feet per minute; water, 459 cubic feet per minute; cream, 535 cubic feet per minute.

A main outlet pipe, 20 inches in diameter, will be required to convey the cream back to the bottom of the shaft through ten miles of level tunnel, and the cream will have to flow through it at a velocity of 245 feet per minute or 4 feet per second. The total head required to force the cream to the bottom of the shaft is 214 feet, or 21½ feet per mile. This represents a force of 224 horse power, the pressure in the pipe being 96 pounds per square inch.

To lift the cream from the bottom of the shaft to the surface will require a total of 525 horse power.

The cubic foot of cream of the above admixture weighs 72·06 pounds. If we now add up the powers required for the several operations, we find:

	Horse power.
(1) For cutting the chalk	340
(2) Reduction of chalk to cream	55
(3) Conveyance of cream to bottom of shaft through 10 miles,	224
Total required at the face	619

As we have provided 1,377 horse power, there will be no deficiency, even if the hydraulic motor should only yield 50 per cent duty, which is a very low estimate.

The 525 horse power required for lifting the cream to top will, of course, have to be provided for at the top of the shaft, and will be in addition to the power necessary for the compression of the water.

To compress 459 cubic feet of water per minute to a pressure of 512 pounds per square inch, or about 1,200 feet head, would require a force of 1,040 horse power.

We have, therefore, to provide on top of shaft—

	Horse power.
For compression of water	1,040
For pumping up the cream	525
Total	1,565

to carry out the entire operation of cutting required, 172 cubic yards per hour, reducing it to cream, and conveying it to the surface in pipes and into the sea.

This power is independent of that required to transport the material necessary for lining the tunnel, which will be done by locomotive or other means, the same as that employed in the ordinary system.

The Preservative Treatment of Timber for Railway Cross Ties.

The *National Car Builder* estimates the yearly consumption for cross ties for new roads, and for replacing worn out ties on old tracks, roughly at thirty millions, assuming the average life of the ties now in use to be about seven years. The annual increase in track mileage, if it is to continue at a rate approximating that of the past year, with a corresponding increase in the great volume of traffic, points to a continuous yearly increase in the consumption of timber for ties for an indefinite period in the future—a home consumption strictly, and not including timber exported for like uses on the roads of foreign countries. How to meet this prospective demand with our annual increase in track mileage without causing such an excessive draught on our forests gives the problem of future supply a greater importance every year.

With respect to cross ties more particularly, attention has of late years been directed to three methods to check the excessive consumption of timber material, namely, preservative treatment, tree planting, and the substitution of iron ties for wooden ones. What is wanted, so far as wood is concerned, is a material that will have twice the durability of the ties now in use, and at the same time cost less, or at all events not any more, for a given period. If the average life could be doubled, it would save a vast quantity of growing timber, and also the cost of one renewal for the total track mileage. This would go far to compensate for the cost of treatment, or the cultivation of timber of exceptional durability and capacity of service, like the catalpa, for example. Tree planting and the use of iron will avert the impending evil to some extent, no doubt, but the main reliance must be upon methods which will make the various kinds of timber now in general use for ties more lasting, by subjecting it to some kind of preservative treatment that is both effective and cheap. Many processes for accomplishing this have been tried and recommended, some of which are reported as having been very successful in Europe, but as yet they have scarcely passed the experimental stage even there, while in this country none of them are in general use, and very few have been put to a satisfactory preliminary test even. These methods, although various, all aim to render the timber less perishable by expelling the sap and all humidity, and then filling the pores or cells with creosote oil, or with a solution of certain metallic salts, both of which have the quality of arresting fermentation and preventing decay—a treatment somewhat analogous to embalming as practiced upon human bodies to arrest decomposition. These processes are known under many names, the more noted of which are the Kyan, Burnett, Bethell, Hayford, and Boucherie methods. The most effective agents appear to be chloride of zinc and creosote, the preservative effect on the timber being about the same for each, but the creosote treatment being twice as expensive as the zinc, the latter is mostly used on foreign railways, and to these we must at present look for the best information extant upon the subject.

The preservation of timber by artificial means has been resorted to more or less in this country for many years in cases where it was to be used for the foundations of heavy masonry and structures of great weight and durability, but for railway ties, telegraph poles, driven piles, and a host of other uses to which timber is applied, its preservative treatment has been little thought of, and nothing very definite has been realized in practice. In practice one thing is quite certain, and that is that soft, porous timbers, such as pine, fir, hemlock, spruce, and the like, can be rendered vastly more serviceable and lasting for cross ties by creosoting or by impregnation with solutions of zinc than if used in the natural state or with ordinary seasoning, especially upon roads with light or medium traffic and with tolerably good ballasting.

With respect to economic results, the reports from the German and Austro-Hungarian roads are the most definite. The ties used are mostly of oak, pine, fir, and beech, and nearly one-half of the total number in use have been subjected to antiseptic treatment according to various systems, with a reported increase in their average life over and above the average life of untreated ties, as follows: Oak six years, fir seven years, pine nine years, and beech nine years.

If preservative treatment is profitable on European roads, where the scarcity and cost of timber naturally lead to close and careful investigation in order to get at the truth, the *Car Builder* inquires why the same thing cannot be made profitable here, irrespective of any threatened exhaustion of our existing timber resources? There is no very obvious reason why it cannot, except that it is a new economic rut to get into after being so long accustomed to plentiful supply and wasteful profusion, and everybody knows how difficult it is to introduce innovations in the face of long established usage and the prejudices thereby engendered.

The Ready Made House Industry.

The Canadians are making such a considerable and profitable business of ready made house manufacture that the *Northwestern Lumberman* (Chicago) thinks it strange that Americans, who have the reputation for seizing new opportunities for money getting, do not branch out in this direction more extensively.

Illustrative of the manner this industry is progressing, it is mentioned in the London, Ont., *Advertiser* that the Truaxes planing mills at Walkerton, are turning out material for ready made houses at a rapid rate. Orders for a whole row of houses can be filled in a few days, and it is not uncommon to see an entire street for Brandon or a block for Winnipeg sent out on a train twenty or thirty days after the order has been received. During the past season Messrs. Truax shipped 219 cars of knock down house material to the Northwest. One of the partners in the concern accompanies each train, and superintends the putting up of the houses. Sometimes houses are ordered by telegraph in this fashion: "What can you furnish me a tidy cottage for, 22x40 feet, with bay window and veranda?" Next spring the enthusiastic house builders expect to receive orders for entire villages, something after this style: "What is your lowest figure for five stores, two wagon and two blacksmith shops, one Methodist and one Presbyterian church, twenty-five cottages, a town hall, and a lock-up, to be delivered on or before July 1?" Orders have been received for twenty-one houses to be put up in Brandon next spring. The freight rate on these houses from Walkerton to Chicago is $40 a car; from Chicago to Minneapolis $20 a car. The charge the balance of the way is enormous, owing to the lack of competition, the cost of a medium car through from the start to Winnipeg being $361. The large ones used by the Truaxes cost more. Considering the fact that Chicago is nearer Winnipeg than Walkerton, Ont., why cannot, adds the *Lumberman*, the knock down house business be made profitable here, and still more so at Minneapolis, Duluth, or any other lumber point in the Northwest?

An Electromotive Torch.

Dr. Brard, of La Rochelle, some time since announced his discovery of a method of preparing blocks of combustible matter, capable of being used as fuel, which at the same time developed a current of electricity. See engravings in SCIENTIFIC AMERICAN, October 28, 1882. Proceeding on the same lines, Dr. Brard has succeeded in making a kind of torch which yields a current of electricity in burning. He makes first of all an inflammable wick of coal dust and molasses, moulded into a rod. A thin sheet of asbestos is then wrapped round this wick, and the whole is dipped into fused nitrate of potash until a good thickness of the material adheres. When the wick of the torch thus made is ignited, a current of electricity may be detected in a circuit of wire connecting the coal paste and the nitrate of potash. It does not appear that such a torch is at all a good one for giving light, and, indeed, the contrary might be inferred from the materials used in its construction. Neither does it develop a useful current of electricity, for the electromotive force produced is insignificant. Still the discovery is regarded as important, because it proves the possibility of electro-generative fuels. It also affords a starting point for the imagination of sanguine individuals, who have already begun to speculate on the time when the fireplaces of living rooms will be made available for supplying electricity—not only for ringing bells, but also for charging accumulators, and thus giving light also. It is reported that Dr. Brard has this latter object in view.

Hemlock Bark.

There are produced annually in North America 100,000 barrels of hemlock bark extract, of which a single Boston firm produces 72,000 barrels. They own nine extract works and operate twenty-three tanneries. All the tanneries of the United States consume annually 1,250,000 cords of hemlock bark, produced in nine States. As the yield of bark is about seven cords to an acre of hemlock timber, the yearly consumption implies the clearing of 178,000 acres. In the main, the bark is stripped from trees cut for timber; and as the demand for this timber exceeds the supply, the supply of both timber and bark is threatened with speedy exhaustion

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Correspondence.

"Indian Holes" on Lake George.

To the Editor of the Scientific American:

While camping on Lake George last summer, my attention was directed to the "Indian holes," as they are called, near the foot of the lake. They were pointed out by an old resident, and owing to the obscurity of their location, must be rarely seen by tourists. The visitor to that beautiful region may find them on a small rocky projection in a bay, about a mile south of "Rogers' Slide," on the western shore, in Hague, N. Y. My curiosity to see them was aroused by being told that there the Indians had been accustomed to grind their corn.

These aboriginal mills, if such they may be called, consist of about a dozen well defined "pot holes" in a solid ledge of gneiss, and are grouped together in an area of a few square yards.

The majority of these have a circular opening and the greatest diameter at the center. One, a well 2 feet in width and 3 feet deep, is cut as neatly in the rock as if bored by artificial means. This and several others were filled with stagnant water, which was frequented by swarms of mosquitoes in their several stages of development and other larval congeners. The largest which I observed was nearly 4 feet across, and probably 5 or 6 feet in depth, although I was not able to determine this accurately, as it was filled with earth. Many of the old inhabitants would doubtless still affirm that these were the work of the Indian.

It is very evident that the configuration of the surface was essentially different, when these curious pits were formed, from what it is at the present time. Long and persistently must a powerful torrent have rolled over these ledges to have kept the stones in motion, which slowly drilled their way into the hard rock, and produced the results which we see to-day. Up to a comparatively recent date they may have been filled with soil and detritus. The red man then found them, and excavated such as were suited to his purpose, removing also the stones which had been instrumental in the work. Here was mortar and pestle for him ready made. None of these grinding stones were seen, yet it is likely that some of them are still there.

It is not *known*, of course, if the Indian ever used these stone mortars for domestic purposes, but it is highly probable that he should have done so, for here was a favorite hunting ground, and doubtless the best of fishing, certainly the best which the lake now affords.

Here, making temporary encampments at certain seasons, he might prepare a supply of ground corn, or else, while passing to and from Champlain, he would merely turn his canoe in hither to pulverize a few handfuls of maize. Mingling this with the limpid waters of the Horicon, he would soon have bread enough baking over his fire, with which to satisfy his appetite for bass and venison.

F. H. HERRICK.

Rock Pt., Burlington, Vt., Feb. 12, 1883.

Flying.

To the Editor of the Scientific American:

I see it stated in your article on flying that the albatross is the largest flying bird. In the year 1858 I was in Nebraska, on the Missouri River, at a place called St. Helena, about two miles below the mouth of the Little James River, and one hundred miles east of Fort Randall. There I ate a piece of a wild turkey, shot by an Indian, that weighed, feathers and all, thirty and a quarter pounds. The flapping of his wings broke off quite large branches of the cotton wood trees, through which he was flying at the time he was shot. How, then, can it be said in view of this fact, for fact it is, that the albatross is the largest flying bird? It seems to me that weight, not bulk, is meant in your article.

The bird has the same relative advantage with his wings in the air as the man has with his legs on the ground, has he not? Hitch a rope to five such birds standing on their legs to pull against a man weighing one hundred and fifty pounds —would not the man be equal to their united strength? If so, how then have the birds greater muscular power than the man, even though the birds use both wings and feet, saying nothing about one albatross being equal in muscular strength to one man?

As sure as the world, I think I could pull more than five thirty and a quarter pound turkeys. It seems to me that the muscular strength of man is not concentrated enough nor located in the right place to enable him to fly, not that he has not the strength.

SAMUEL R. GOODSELL.

Brooklyn, N. Y., Feb., 1883.

Horn and its Uses.

Under the general name of horn may be included (chemically considered) a great variety of tough, somewhat flexible, semitransparent organs intended by nature for defense or covering; of this kind are the hollow horns of the ox, goat, ram, and some other animals, the hoof, the horny claw and nail, and the horny scale of certain insects and animals, chiefly cold blooded, such as the shell (so called) of the tortoise. All these resemble each other very closely in chemical character, and differ considerably from some of the harder and bony defences of some animals, such as the stag's horn, ivory, and the hard tusks of the sea cow, and many others.

Horn (used in the above general sense) has various degrees of hardness, but is always in some degree tough and flexible, even in the cold, so that, however dried, it cannot be bruised to powder as bone can. It is also distinguished from bone very remarkably, in being softened very completely by heat, either naked or through the medium of water, so as then to be readily bent, moulded, and made to adhere by pressure to other pieces of horn in the same state. No such change takes place with bone.

The valuable experiments of Mr. Hatchett, with those of preceding chemists, have also shown a most decided chemical difference between horn and bone. When bone is boiled with water in an open vessel, a large quantity of gelatine is extracted, and the insoluble residue consists of the earth of bone, together with albuminous cartilage, so that the texture remains unbroken. On the other hand, the different species of horn boiled with water, even for many days, give to it but very little gelatine, the softer and more flexible horns giving the most. The horn itself during the digestion is softened considerably by the hot water, but on being taken out and dried, it becomes more brittle than at first, and in proportion to the loss of gelatine. Bone therefore contains much gelatine, and horn scarcely any.

Another difference appears after the utmost action of fire on each. When bone is burnt, a number of substances are procured, and the last residue is an earthy salt, chiefly phosphate of lime, amounting on an average to from half to one-third of the entire weight of the bone. When horn is treated in the same way, the volatile products are indeed the same, or nearly so, but instead of a large earthy residue, scarcely any earth or any other combustible matter remains. Bone therefore contains much phosphate of lime, but horn hardly any.

But the substance which they possess in common is that condensed tough matter, insoluble in water and weak acids, which Mr. Hatchett has so satisfactorily shown to resemble albumen in all essential properties, and which in bone forms the original organic cartilage on which the earth is deposited during the growth of the animal, and in horn forms almost the whole substance.

Horn seems to consist in by far the largest proportion of condensed albumen, combined however with a small and varying portion of gelatine, which modifies its texture and flexibility, and also with a small portion of phosphate of lime.

It has been mentioned that boiling water in open vessels had hardly any action on horn, but when confined in a digester, horn as well as bone is totally soluble, because water assisted by the strong heat of a digester will dissolve condensed albumen as well as gelatine. This method therefore is not sufficiently distinctive for chemical analysis.

The fixed alkalies readily and totally dissolve horn into a yellow saponaceous liquor.

The products obtainable from horn and bone of all kinds by distillation *per se*, were early attended to by chemists, as it is from these substances that a variety of valuable ammoniacal salts and preparations are obtained.

The products from bone and horn by fire are very similar, and it is only the soft parts, such as gelatine and albumen, that are decomposed in the process, the earthy phosphate remaining inert without adding to or modifying the volatile products. These latter are a weak ammoniacal phlegm or water, on the first impression of the fire, to which succeeds an oil, thin and limpid at first, but afterward brown and foul, and at last of a pitchy color and consistence, and an extremely fetid and empyreumatic smell. During the whole of the distillation, carbonate of ammonia comes over, partly dissolved in all the liquid products and partly concreting on the sides of the receiver in crystalline plates. A second distillation with regulated heat is used to procure the ammonia purer; but it can hardly ever be totally freed by this means from the volatile oil; so that, though limpid and gratefully ammoniacal, the alkaline liquor or salt thus obtained always retains somewhat of the peculiar smell of the oil, as must be observed by every one who compares the scent of common spirit of hartshorn with that of the pure carbonate of ammonia or sal volatile, which is prepared in a different way and from other materials.

But horn (properly speaking) is seldom employed for the purpose of distillation, being too valuable as an article of manufacture to be thus sacrificed. The only horn ever used is the stag's horn or hart's horn, which, as above mentioned, partakes much more of the nature of bone, is not flexible like ox and other horn; when in shavings, readily dissolves by boiling water into a pure nutritious jelly, entangling the phosphate of lime along with it, which makes it slightly opaque. Stag's horn, therefore, is somewhat intermediate between bone and true horn.

Horn and tortoise shell being applied to a number of mechanical purposes, must be cut, bent, and shaped in an infinite variety of ways. This is done in most instances by the assistance of heat applied either dry or by softening the horn in boiling water, and sometimes with the assistance of a weak alkaline liquor. When thus softened, one part may be made to adhere to another by mere pressure as firmly as the undivided substance. Thus, for example, to make the horn ring that surrounds a common opera-glass, a flat piece of horn is cut out of the requisite shape, the ends intended to join are thinned down by a file, the piece is then put into boiling water till sufficiently supple, and is then rolled round a warm iron cylinder, and held in that position by a vice, so that the ends envelop each other. Another piece of iron heated and grooved is then laid upon the seam of the jointed ends, and pressed upon the cylinder, and confined there by iron wire; and the heat of the two partially melts that portion of the horn, and cements the ends so completely that no seam or joining can be observed when cold.

In a similar manner two pieces of tortoise shell may be joined together by first neatly shaping with a file the parts that are to be united, then tying a thick paper doubled in several folds over the joining, and pressing the whole together with a hot iron instrument like curling irons, heated just sufficiently that the shell when warmed by it will begin to bend by its own weight. When cold the joining is perfect, and without seam. Too great heat would make the shell rise in opaque blisters, and spoil its beauty.

Horn is made to imitate tortoise shell in the following manner: Make a paste with two parts of quicklime, one of litharge, and a little soap-maker's lye, or solution of caustic potash; apply it skillfully on a thin plate of horn in a way that will best imitate the natural spots of the tortoise shell, leaving the light parts untouched; let this paste dry on, then brush it off, and the horn will be permanently stained. The effect is much improved by laying beneath it, when used, a piece of brass leaf. This staining may be varied at pleasure by substituting other colored substances for the litharge.

The tips of horns are used for knife handles, buttons, and other purposes. Horn for knife and whip handles is sawed into blanks, heated, pared, and partially shaped; then heated in water and pressed between dies. It is afterward scraped, buffed, and polished. Deer horns are worked like bone or ivory.—*Glassware Reporter.*

Falsification of Brandy.

A lamentable picture has been drawn in a recent report of the American Consul at Rochelle of the falsification of brandy, which, it appears, in the last three years has undergone a complete transformation, and is no longer brandy, the greater portion being prepared from alcohol of grain, potatoes, or beet. The most unsatisfactory circumstance is that even the merchants who desire to purchase a pure cognac cannot be certain that they do so, for the proprietors of the vineyards, all of whom are distillers, have become so clever in the manipulation of alcohols and the accompanying drugs that they deliberately make a brandy of any required year or quality. The mention of the years 1849 or 1876, for instance, in an invoice or on a label, means simply that the article is presumed to have the taste or color of the brandies of those years. The increasing importation of German potato and beet alcohols into the Charente ports is an additional proof that the less brandy that is consumed, the better for the health and intellect of the consumer.

It is, moreover, becoming a custom to sell the brandy in 12 bottle cases, marked with one, two, or three stars according to the presumed quality, thus avoiding any compromising mention of year or place of production. Some of the manufacturers import the small raisins from the East and make what they call brandy from the juice, there being at least one such establishment in operation at Cognac. Apart from the unsatisfactory purchase of a brandy which is not a brandy, drinkers should seriously consider what are the properties of the liquid which they are so complacently imbibing. It is simply an active poison, the imported alcohol, which is known to the trade as "*trois-six*," being of 90° strength, and sold at a little less than three francs a gallon. Its characteristic effect is to produce an intoxication in which the patient is especially inclined to rage and physical violence, while insanity, of an obstinate and almost hopeless form, is the inevitable consequence of a prolonged use of it. It is said that the great increase of violent and brutish crimes in France may be traced to the drinking of this brandy and absinthe. The slang term for a glass of cognac is *un petrole*, and for coffee with cognac, *un grand deuil*. Not only in France, but in other countries, and even in the United States, these liquors are producing a condition of national alcoholism of the worst kind, far beyond the ordinary drunkenness arising from unadulterated intoxicating drinks.

Ancient Mode of Baking Walls.

Among the recent discoveries at Hissarlik by Dr. Schliemann are the remains of buildings which he supposes to have been temples. The walls are respectively 1·45 meters and 1·25 meters thick. Nothing, he says, could better prove the great antiquity of the buildings than the fact that they were built of unbaked bricks, and that the walls had been baked *in situ* by huge masses of wood piled up on both sides of each wall and kindled simultaneously. Each of the buildings has a vast vestibulum, and each of the front faces of the lateral walls is provided with six vertical quadrangular beams, which stood on well polished bases, the lower part of which were preserved, though, of course, in a calcined state. Dr. Schliemann maintains that in these ancient Trojan temples we may see that the *antæ* or *parastades*, which in later Hellenic temples fulfilled only a technical purpose, served as an important element of construction, for they were intended to protect the wall-ends and to render them capable of supporting the ponderous weight of the superincumbent crossbeams and the terrace. Similar primitive *antæ* were found in two other edifices, and at the lateral walls of the northwestern gate. It was also discovered that the great wall of the ancient Acropolis had been built of unbaked bricks, and had been baked like the temple walls *in situ*. According to Dr. Schliemann, a similar process of baking entire walls has never yet been discovered, and the *antæ* in the Hellenic temples are nothing else than reminiscences of the wooden *antæ* of old, which were of important constructive use.

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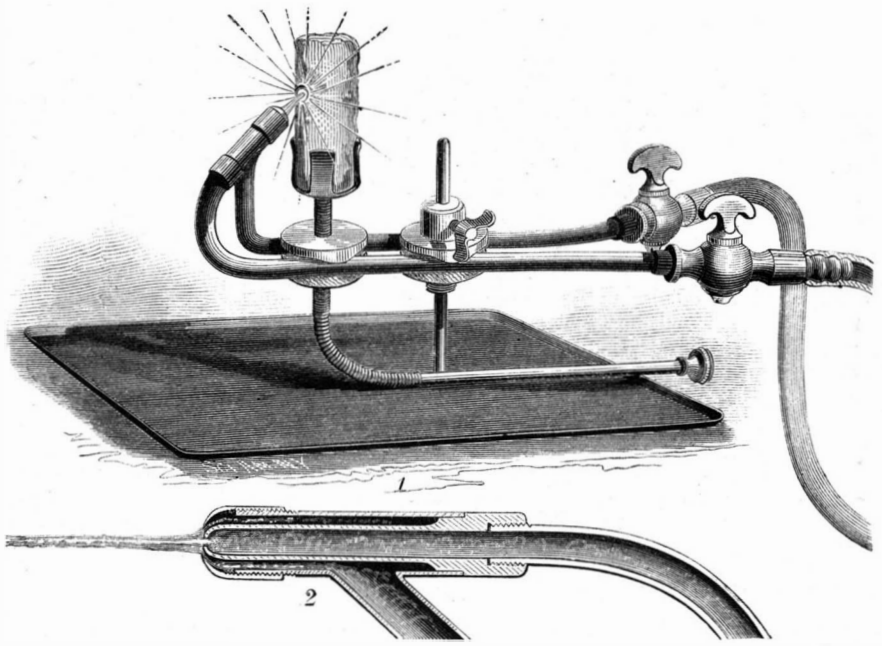
LANTERN ILLUMINATION.

BY GEO. M. HOPKINS.

The most available and satisfactory illumination for ordinary projections is the oxyhydrogen or lime light. The two -forms of compound blow pipe generally employed for this purpose have their defects, as every user of the instrument knows. The form in which the two gases are mixed within the nozzle, and projected through a common orifice, produces by far the stronger light, but its use is fraught with danger. The concentric or annular form of blow pipe, in which the gases are mingled as they issue from their respective orifices, is perfectly safe, it being impossible for the gases to mix in the tubes or gas holders; but ordinarily it is necessary to employ a superfluity of hydrogen gas to realize the full effect of the oxygen jet. This is especially true where illuminating gas is used instead of pure hydrogen.

The result of this extra amount of gas is a large and intensely hot flame, surrounding the incandescent spot on the lime and flaming out in all directions. This impairs the light, heats the lantern, and endangers the condenser, which is very liable to become broken by the heat.

The engraving shows a modified annular oxyhydrogen burner, in which the serious defects of its predecessors are overcome, while their good qualities are preserved; at the same time the illuminating power is increased. The central or oxygen tube has a conical end with a central orifice 0·03 inch in diameter. The hydrogen tube is provided with an adjustable cap, having a central orifice 0·1 inch in diameter. The cap is conical internally and externally, and when properly adjusted, as shown in the sectional view, the thin space between the internal surface of the cap and the conical end of the oxygen tube forms a passage for the hydrogen, which directs it across the path of the jet of oxygen. By this simple device the gases are intimately mixed at the moment of ignition, and the result is a clear, intense light with no superfluous flame, and with little free heat. The performance of the burner compares favorably with those that mix inside, while it is perfectly safe, and may be used with gas cylinders or bags and with ordinary illuminating gas at the usual pressure.



IMPROVED OXYHYDROGEN BURNER.

A simple and effective device for turning and elevating the lime holder is shown in the cut. It consists of a spiral spring soldered to the lime holder spindle, and secured to a rod extending to the back of the lantern. It is, in fact, a small use of the "flexible shaft." By turning the rod the lime is turned and elevated.

NEW BAG AND TWINE HOLDER.

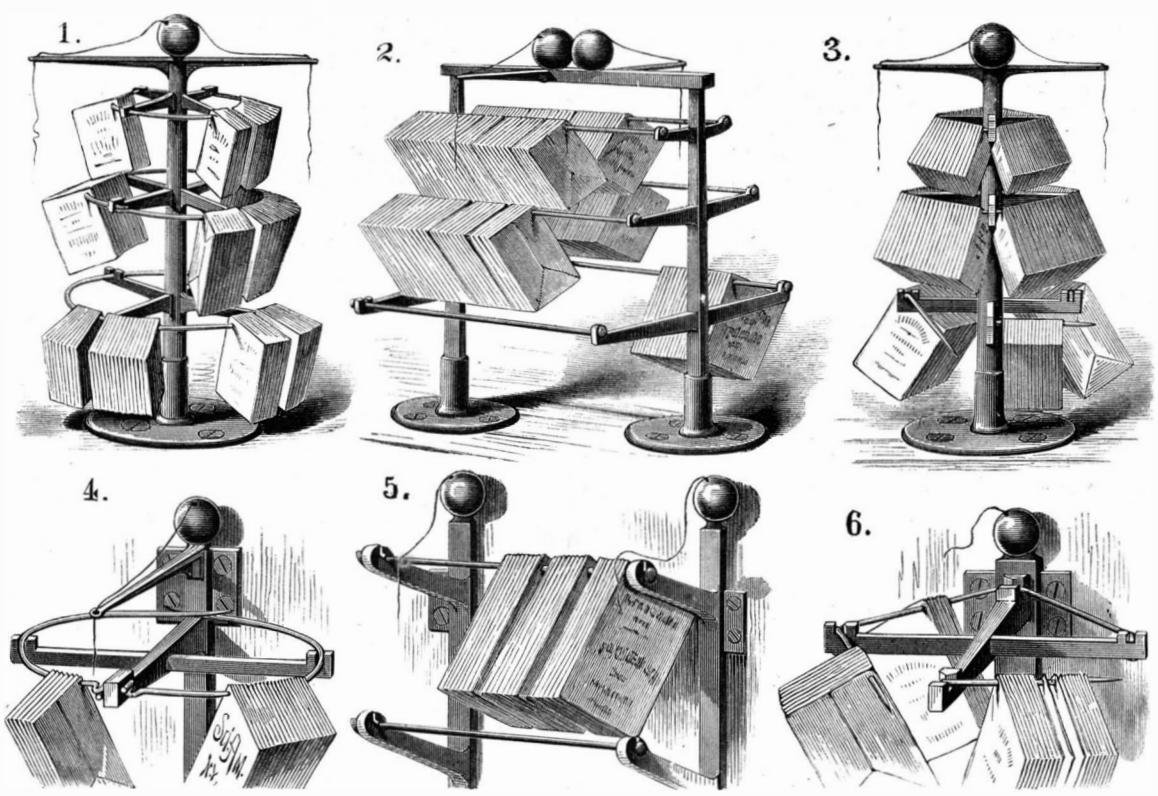
The engraving shows several forms of a novel paper bag and twine holder for grocers and others who use paper bags for putting up goods. The essential feature of the invention is a stand or support of suitable form, with wire pins, rods, or hoops fixed thereon in a convenient way, so that they may be wholly or partly detached for stringing the bags on them, and replaced in retaining hooks or notches, to support the bags in position to be readily detached when wanted for use. Twine ball cups are provided for holding the twine for tying the bags.

The several figures in the engraving represent different forms of the invention.

The holder may have one or more standards attached to a base or other support. To each standard are attached horizontal arms for supporting the wire pins, hooks, or rods on which the bags are strung. The pins are fixed so that their points can be readily freed from their supports at any time when it may be required to replenish the stock, and at the same time be so placed, when returned to their resting places, that the stripping of the bags from them will not dislodge either the points or the heads. For this purpose the pins may be connected to the arms in various ways, and the connecting devices may also be varied to suit the forms and arrangements of the pins and their supporting arms. For instance, in Figs. 1 and 4, where the wire forms a circle or hoop around the standard, two of the arms may have hook ends, in which the bent or notched head of one pin and the point of another may be lodged, as shown, the other arms having a notch in which the pins rest at the middle, the pins being bent so as to extend half-way around the stand and spring into the hooks and notches, so as to be readily put in or taken out, the tension of the wire keeping them in place when lodged therein. In Figs. 3 and 6 the pin heads are bent at right angles and pivoted to the notches in the arms, so that the points will spring into the notches of the adjacent arms. In Figs. 2 and 5 the heads of the rods have a collar, and the points rest in the notches in the arms by their weight, the said head and collar preventing the rods from shifting lengthwise, and the notches are crooked, to prevent the accidental escape of the rods in case of being thrust upward.

When the device is arranged as in Figs 4, 5, and 6, it may be attached to the wall or a column, or other suitable support. This device enables the dealer to take the bags one by one for use, the object being to so arrange the bags that one can be readily selected from the rest, and can be detached without disturbing or scattering the others, and at the same time to hold them so securely that they will not be accidentally scattered.

This device has been patented by Mr. Louis Steinberger, of Bradford, Pa. (P. O. Box 1,933).



BAG AND TWINE HOLDER.

The St. Gothard Railway.

It was naturally to be expected that the opening of the St. Gothard Railway would divert the bulk of the Italian trade into the hands of Germany, Belgium, and Holland. This is being accomplished with surprising rapidity. Early fruit and vegetables are conveyed without transshipment from all parts of Italy to Ostend, Antwerp, and Rotterdam, whence they are taken by fast steamers to London and other English ports. The Great Eastern Railway Company alone is stated to have carried over 6,000 tons of these goods, *via* Antwerp and Harwich, in a few months. Malta is now likewise brought nearer, and Algerian produce, such as green peas and early potatoes, is made more available. On the other hand, Italy is receiving an unprecedented, not to say overwhelming, amount of attention from Germany. In two months after the opening of the St. Gothard route the Germans dispatched 40,000 tons of coal, 107 tons of unmanufactured iron and hardware, 14,000 tons of machinery, 693 tons of copper, 17,409 tuns of spirits, 1,446 tons of paper, and 76 railway wagons—the export of all these articles having previously been either *nil* or quite nominal.

Refining Shellac.

Ordinary commercial shellac, it is well known, when treated with alcohol does not furnish a clear solution, but always produces a more or less turbid, yellowish solution, which, when warmed, clears itself by forming a brown solution and throwing down a grayish-yellow sediment. Also by filtration through good thick filter paper, a perfectly clear solution can be obtained, but this succeeds only when there is about ten per cent of shellac in the solution, and not in working on large quantities. Of course, there is no difficulty in subsequently concentrating the thin solution by evaporating the excess of alcohol, but the filtration of large quantities is attended with loss of time and material, as well as other difficulties, for it is not easy to make the filters tight enough to prevent loss of alcohol, and the filter paper has to be frequently changed.

Dr Peetz proposed to add finely pulverized chalk or carbonate of magnesia, which would carry down the light particles of wax that make the solution turbid. This may answer for small quantities, and where the cost of manipulation is not taken into account, but is absolutely useless for large quantities.

Shellac is not a pure natural product, but is prepared from stick lac by melting, straining, and washing. Both in stick and shell lac there is a substance which some chemists call wax and others fat, that will not dissolve in alcohol and ether, but is soluble in benzine, naphtha, etc. Dr. Peetz adds to three parts of shellac solution one part of petroleum ether and shakes well. After standing quietly for a few minutes the liquid forms two layers; the upper light brown one is petroleum ether containing the dissolved fat or wax, while below is a clear yellowish-brown solution of shellac to which only a little naphtha adheres. On removing the upper layer and allowing it to evaporate spontaneously, a white residue is obtained, consisting of the fat that was in the solution. This fat can be saponified with caustic alkali, but is not dissolved by carbonated alkali, and on this property depends the new process for refining of shellac.

Edgar Andes, of Vienna, has been experimenting upon the best methods of refining shellac, and communicates his results to *Neuste Erfindung*. Passing by the details of his experiments as given in the original, we give his final results. He says: "I have come to the conclusion that for the preparation of a perfectly soluble shellac, that shall retain its other qualities unchanged, ten pounds of shellac should be treated with three pounds of soda (carbonate of soda) dissolved in ninety pounds of water.

"The operation is conducted as follows: The water is heated to boiling in a suitable kettle, the soda added next, and when that is dissolved the shellac is put in slowly, waiting for the first portion to dissolve before adding more. The liquid has a pink color and the well known agreeable odor of shellac. It is turbid from the small amount of fat in it. After all the shellac is dissolved, the solution is boiled a few minutes longer, and the kettle covered with a tight fitting wooden lid, which is luted on with clay, so that no air can enter. It is then allowed to cool slowly, and when the cover is at length removed, a thin cake of fat will be found floating on the liquid.

"This is removed and the liquid strained through linen. The shellac is then precipitated with dilute sulphuric acidadded drop by drop. The yellow shellac is washed until it is no longer acid. The well pressed cake is put in boiling water, when it becomes softened, so that it can be worked by the hands into rods, strings, or rolls, which are next put in cold water containing glycerine, so that it will harden quickly, and then dried.

"The hot, soft shellac must be squeezed, wrung, and pressed to remove all the water. This refined shellac has a silver white brilliant surface, is yellowish-brown within, and must be perfectly dry, so as to dissolve without residue in alcohol." The presence of water in alcoholic solutions of any resin makes it turbid and milky.

THE venerable Professor Listing, of Gottingen, died in that city, December 24, in his 75th year. Professor Listing numbered many warm friends among his scholars in this country, who will hear of his death with profound regret.

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THE ÆOLIAN HARP.

The Æolian harp is a musical instrument which is set in action by the wind. The instrument, which is not very well known, is yet very curious, and at the request of some of our readers we shall herewith give a description of it.

According to a generally credited opinion, it is to Father Kircher, who devised so many ingenious machines in the seventeenth century, that we owe the first systematically constructed model of an Æolian harp. We must add, however, that the fact of the spontaneous resonance of certain musical instruments when exposed to a current of air had struck the observers of nature in times of remotest antiquity.

Without dwelling upon the history of the Æolian harp, we may say that in modern times this instrument has been especially constructed in England, Scotland, Germany, and Alsace. The Æolian harp of the Castle of Baden Baden, and those of the four turrets of Strassburg Cathedral are celebrated.

We shall first describe Kircher's harp, which this Jesuit savant constructed according to an observation made by Porta in 1558. The instrument consists of a rectangular box (Fig. 1), the sounding board of which, containing rose-shaped apertures, is provided with a certain number of strings stretched over two bridges and fastened to pegs at the extremities. This box carries a ring that serves for suspending it. Kircher recommends that the box be made of very sonorous fir wood, like that employed in the construction of stringed instruments. He would have it 1·085 meters in length, 0·434 meter in width, and 0·217 meter in height, and would provide it with fifteen catgut strings, tuned, not like those of other instruments to the third, fourth, or fifth, but all in unison or to the octave, in order, says he, that its sound shall be very harmonious. The experiments of Kircher showed him the necessity of employing a sort of concentrator in order to increase the force of the wind, and to obtain all the advantage possible from the current of air that was directed against the strings. The place where the instrument is located should not, according to him, be exposed to the open air, but must be a closed one. The air, nevertheless, must have free access to it on both sides of the harp. The force of the wind may be concentrated upon such a point in different ways; either, for example, by means of conical channels, or spiral ones like those used for causing sounds to reach the interior of a house from a more elevated place, or by means of a sort of doors. These latter, two in number, are adapted to a kind of receptacle made of boards and presenting the appearance of a small closet. In the back part of this receptacle there is a slit, and in front of this the harp is hung in a slightly oblique position. The whole posterior portion of the apparatus must be situated in the apartment, while the doors must remain outside the window (Fig. 1). In later times the Æolian harp has been improved by Messrs. Frost & Kastner, whose apparatus is represented in Fig. 2. It consists of a rectangular box with two sounding boards, each provided with eight catgut strings. In order to limit the current of air and to bring it with more force against the strings, two wings are adapted near the thin surfaces opposed to the wind, so that the current may reach each group of cords on passing through the narrow aperture between the obliquely inclined wing and the body of the instrument. The dimensions of the resonant box are as follows: height, 1·28 meters; width, 0·27 meter; and thickness, 0·075 meter. Distance between the two bridges, or length of the sonorous portion of the cords, about 1 meter; width of the wings, 0·14 meter. Distance between the sounding board and the wings, 0·42 meter. Inclination of the wings, 50 degrees.

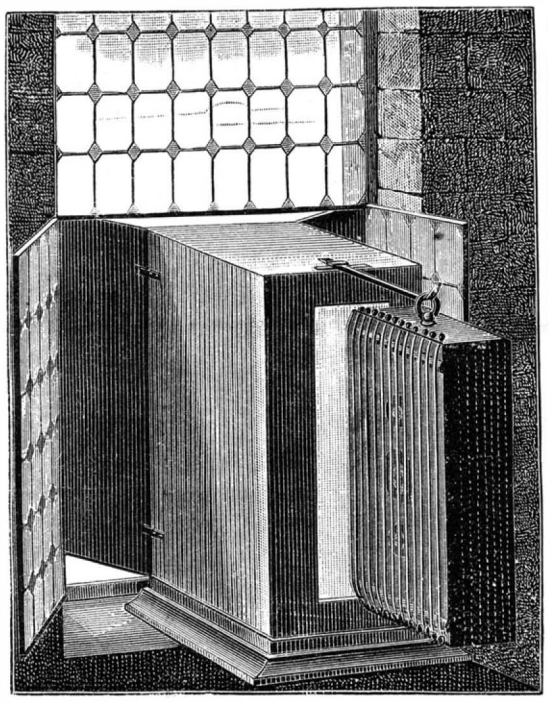

Fig. 1.—KIRCHER'S ÆOLIAN HARP.

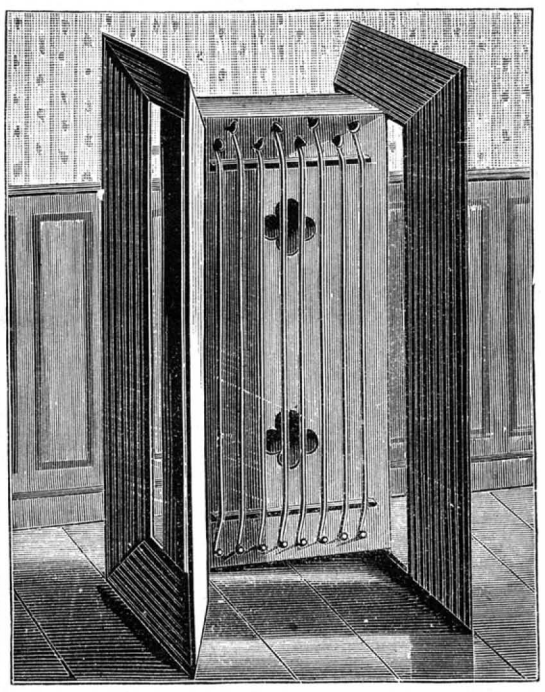

Fig. 2.—FROST & KASTNER'S IMPROVED ÆOLIAN HARP.

The celebrated Æolian harps of the old castle of Baden Baden are entirely different, and merit description. One of them (Fig. 3) is formed of a resonant box, the construction of which differs from that of Æolian harps with a rectangular box, in that it is prolonged beyond the place occupied by the strings, and is rounded off behind. In the opposite side there are two long and narrow apertures. To prevent the apparatus from being injured by the weather, it is inclosed in a sort of case occupying the recess of the window in the old ruined castle in which it is exposed. Behind the harp there is a wire lattice door, the purpose of which seems to be to protect the instrument against the attempts of robbers or the indiscreet contact of tourists. We annex to the general view of the instrument a front and profile plan (Fig. 4). The Æolian harp has often inspired both writers of prose and poetry. Chateaubriand, in *Les Natchez*, compares its sounds to the magic concerts that the celestial vaults resound. Without attributing such effects to the instrument, it must be admitted that it possesses remarkable properties, which act upon the nervous system and cause very different impressions, according to the temperament of those who listen to its accords.

Hector Berlioz, in his *Voyage Musicale en Italie*, has given as follows the curious effects that an Æolian harp produced upon his lively and impassioned imagination: "On one of those gloomy days that sadden the end of the year, listen, while reading Ossian, to the fantastic harmony of an Æolian harp swinging at the top of a tree deprived of verdure, and I defy you not to experience a profound feeling of sadness and of *abandon*, and a vague and infinite desire for another existence."

An English physician, Dr. J. M. Cox, in his practical *Observations* upon dementia, asserts that unfortunate lunatics have been seen whose sensitiveness was such that ordinary means of cure had to be given up with them, but who were instantly calmed by the sweet and varied accords of an Æolian harp. Other observers narrate that they have heard the efficacy of Æolian sounds spoken of in Scotland for producing sleep.

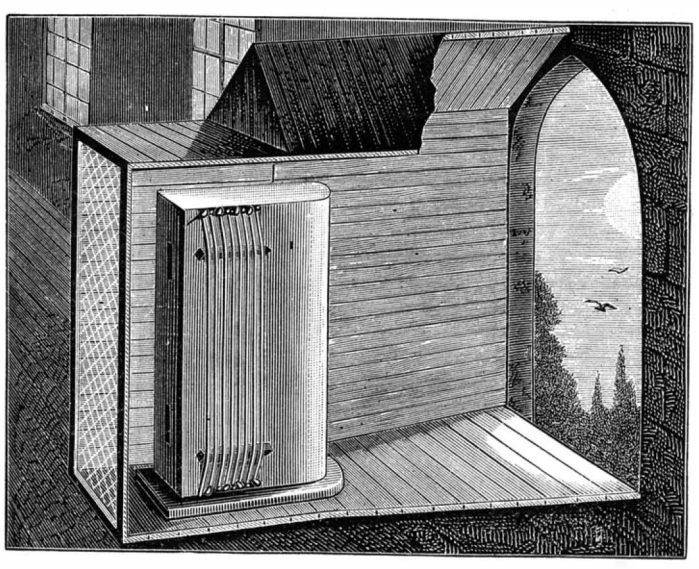

Fig. 3.—ÆOLIAN HARP IN THE OLD CASTLE OF BADEN BADEN.

Telegraph wires are often, under the influence of the winds, submitted to vibrations which reproduce the phenomena of the Æolian harp. The electric telegraph, which, before the construction of the Kehl bridge, directly traversed the Rhine, very frequently resounded, and the observer who placed his ear against the poles on the bank of the river was enabled to hear something like a far-off sound of bells.—*La Nature.*

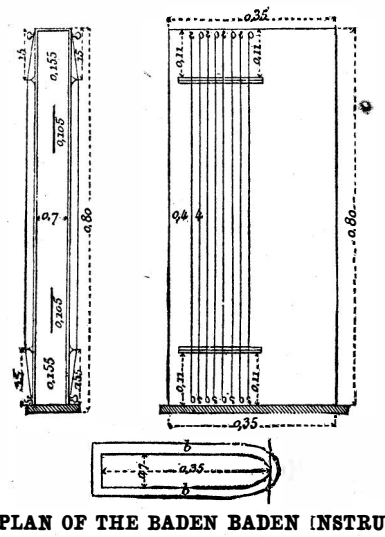

Fig. 4.—PLAN OF THE BADEN BADEN INSTRUMENT.

The Disinfection of Tubercle.

From current theories of the infective nature of tubercle, it naturally becomes exceedingly important to ascertain by what agents its virulence may be most effectually neutralized. A series of experiments on this subject have been communicated to the Academie de Medecine by M. Vallin. Fragments of tubercular pulmonary tissue removed from the body of a man who had died of phthisis were well mixed with distilled water, and fifty centigrammes of the filtered liquid were injected into the peritoneal cavity of a guinea pig. No inflammation was produced, but at the end of a few weeks the animal began to lose flesh, and died at the end of the fourth month. The liver, spleen, and lungs were full of granulations and gray masses, transmissible by inoculation. It was this secondary tubercular substance which supplied the material for the inoculation experiments. With distilled water, an infusion of caseous fragments of the organs was made, and a sheet of filtering paper was saturated with the liquid and then allowed to dry. It was then cut up in strips of the same width, each of which would yield, to a small quantity of water, a similar dose of the virus. Preliminary experiments showed that the inoculation of this produced tubercle with certainty. Some strips of the paper were exposed to the action of various disinfectants. In a chamber fifty cubic meters in area, strips were exposed to the fumes of sulphur for twenty-four hours. The results showed that it was necessary to burn twenty grammes of sulphur in this chamber to render the virus innocuous. When the quantity burned was less than twenty grammes, the animals usually died tuberculous. Boiling water was found invariably to secure immunity, and so also did corrosive sublimate in a solution of one per thousand. The conclusion M. Vallin draws from the experiments is that it would be well every year to purify by sulphurous fumigation all prisons, barracks, hospitals, and schools.—*Lancet.*

Improved Papier Mache Process.

A durable and inexpensive method of employing papier mache as a substitute for mattings, carpets, oil cloths, and other floor coverings has been introduced, says the *Providence Journal*, the simplicity of the process being also an additional advantage in its favor. After the floor has been thoroughly cleaned, the holes and cracks are then filled with paper putty, made by soaking newspaper in a paste made of wheat flour, water, and ground alum, that is, to one pound of such flour are added three quarts of water and a tablespoonful of ground alum, these being thoroughly mixed. With this paste the floor is uniformly coated, and upon this a thickness of Manila or hardware paper is placed, or if two layers are desired, a second covering of paste is spread on the first layer of Manila paper, and then the second thickness of paper is put on, and the whole allowed to become perfectly dry; on this being accomplished another surface of paste is added, succeeded by a layer of wall paper of any style or pattern desired. On the work becoming entirely dry, it is covered with two or more coats of sizing, made by dissolving one-half pound of white glue in two quarts of hot water, and when this has dried, a coat of "hard oil finish varnish," nothing more being required after the latter has had time to become thoroughly dry in every part.

The Niagara Ice Bridge.

An unusually extensive and interesting ice bridge was formed early this winter across the Niagara River below the falls.

The architect of this stupendous structure, says an intelligent observer, is the south wind. A steady blow from this quarter causes the ice in Lake Erie, twenty-five miles away, to break up into gigantic fragments, which float down the current of the Niagara until they shoot the rapids and plunge over the cataract—a sight worth a long journey to see. Below the falls some of these enormous cakes lodge, here against a rock, there upon the beach at the foot of a cliff. Others follow, and, tossed by the seething billows against their predecessors, find lodgment also. They are welded by the frost and dashing foam, and this process goes on until the river is covered from shore to shore. The accumulation increases, the cakes of ice being forced under the mass by the pressure of the waters, until, as now, the bridge extends from shore to shore, and from the foot of the great cataract away down nearly to the railway suspension bridge, three miles, and of a thickness often equal to the tallest of city business blocks.

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Substances Used in Amalgamating.

The application and modification of the amalgamation process, as practiced on the Comstock, has occasioned among experienced millmen great doubt as to the beneficial results derived from the use of any chemical agents at present mixed with the ore. This doubt is occasioned, or at least strengthened, by the custom of late years of decreasing the quantity of salt and sulphate of copper added to the charge, without apparently diminishing the product of bullion. Many amalgamators now abstain from the use of both reagents; others add a small quantity of sulphate of copper, but no salt; in a few instances the custom is to throw in only a little of the latter, while in many mills the rule is to employ a small amount of both substances, owing to a slight prejudice against the abandonment of "chemicals" altogether.

The action exerted by these two reagents in the pan would appear clearly to indicate that the benefits derived from their use are partly to aid in converting the sulphide into chloride of silver, as in the patio, and partly to decompose such minerals as are but slightly attacked by the mercury. In the Comstock process, however, the large quantity of iron present must tend greatly to produce subchloride of copper almost as soon as the chemical agents are thrown into the pulp.

Notwithstanding the importance of common salt and sulphate of copper in the patio, and, under certain conditions, in the pan, their value must be considered as only secondary in the decomposition of a large proportion of the Comstock ores. The advantages derived from their use are shown to be exerted chiefly upon such minerals as blende and galena, which are but slightly attacked by the mercury. But the amounts employed are in most cases too small to effect any favorable results. On the other hand, if a sufficiently large proportion of the reagents are consumed in the pulp, in order to produce the beneficial returns, it is always at the expense of preserving the necessary purity of the mercury. The quantity of salt deemed necessary by millmen varies from one-quarter of a pound up to seven or eight pounds per ton; scarcely any two establishments have the same rule.

The consumption of sulphate of copper also depends upon the ideas of the amalgamators, but the amounts do not differ so widely as in the case of the salt. It ranges from one-quarter of a pound to three pounds per ton.

The addition of the sulphate without salt is of late years a common practice. The opinion among those who work their ore in this way is that it gives a little better yield than when mercury alone is employed, particularly where the ore indicates the presence of galena in any considerable amount, in which case it is said to "quicken" the mercury and render it more energetic.

Continued experience appears to determine this fact with a considerable degree of certainty. In working ores containing only a small percentage of lead, the quicksilver very soon becomes dull and inactive, or, as it is technically termed, it "sickens," and the yield from the pan is consequently low. Lead is one of the most deleterious metals in destroying the amalgamating energy of mercury, and at the same time is very rapidly absorbed when the two metals are brought into contact. Sulphate of copper possesses to a certain extent the property of expelling lead from the mercury, copper being amalgamated and sulphate of lead formed at the expense of the sulphuric acid of the copper salt.

If a concentrated solution of sulphate of copper be allowed to stand upon the lead amalgam, the action takes place quite rapidly, mercury containing lead acting much more energetically upon the copper solution than when perfectly pure.

This salt, however, dees not appear, under any circumstances, to possess the power of completely driving out the lead.

Another advantage derived from the addition of a small quantity of the sulphate of copper is that mercury, under certain conditions, when exposed to the solution, forms a minute amount of copper amalgam, which causes the metal to act with a somewhat greater intensity in the decomposition of the silver sulphide than when perfectly pure. Iron, as a reducing agent in the pan process, probably plays an important part in bringing about the favorable results obtained. This may occur, according to Mr. Hague, in three ways:

First.—It aids in a great measure the decomposition of the chloride of silver.

Secondly.—It reduces the calomel formed during the operation; the chlorine combining with the iron, goes into solution, and the heavy metal is liberated. In this way it not only prevents a chemical loss of mercury, but also serves to keep the surface of that metal bright and clean, which otherwise might be coated with a thin film of subchloride, which would greatly destroy its activity.

Thirdly.—It undoubtedly assists directly in the amalgamation where the two metals are brought into close contact with the easily reducible sulphurets. The successful and continued operations on the Comstock without the aid of any other chemical agents sufficiently prove this statement. The experiments in treating argentite and iron filings with mercury confirm the fact.

Humboldt, in speaking of the amalgamation problem in Mexico, draws attention to this point, and remarks upon the rapidity with which amalgamation was secured when the two metals were triturated together with argentite. This action of iron is obtained not only from the constant agitation maintained, which brings the pulp and metal in contact with the sides and bottom of the pan, but also from the amount of iron disseminated in a fine condition through the ore, produced by the wear of the stamps, shoes, and dies.—*Mining and Scientific Press.*

Consumption of Wood.

It would seem from the following statistics that the inventors of wood sawing and splitting machines have an extraordinarily large field for the use and sale of improved devices.

The Census Bureau has presented its figures respecting the consumption of wood as fuel for the census year 1880. The number of persons using wood for domestic purposes is given at 32,375,074, and the record of the various States and Territories, in amount and value, is shown in the following table:

FOR DOMESTIC USE.

	CORDS.	VALUE.
Alabama	6,076,754	$8,727,377
Arizona	170,017	724,572
Arkansas	3,922,400	5,095,821
California	1,748,062	7,693,731
Colorado	426,719	1,638,783
Connecticut	525,639	2,371,532
Dakota	422,948	3,028,300
Delaware	177,306	751,311
District of Columbia	26,902	80,706
Florida	609,046	1,230,412
Georgia	5,910,045	8,279,245
Idaho	99,910	383,689
Illinois	5,200,104	14,136,662
Indiana	7,059,874	13,334,729
Iowa	4,090,649	14,611,280
Kansas	2,095,438	7,328,723
Kentucky	7,994,813	13,313,220
Louisiana	1,944,858	4,607,415
Maine	1,215,881	4,078,137
Maryland	1,152,910	3,170,941
Massachusetts	890,041	4,613,263
Michigan	7,838,904	13,197,240
Minnesota	1,669,568	5,873,421
Mississippi	5,090,758	7,145,116
Missouri	4,016,373	8,633,465
Montana	119,947	460,638
Nebraska	908,188	3,859,843
Nevada	155,276	972,712
New Hampshire	567,719	1,964,669
New Jersey	642,598	2,787,216
New Mexico	169,946	1,063,360
New York	11,290,975	37,539,364
North Carolina	7,434,690	9,019,569
Ohio	8,191,543	16,492,574
Oregon	482,254	1,254,511
Pennsylvania	7,361,962	15,067,651
Rhode Island	154,953	706,011
South Carolina	3,670,959	11,505,997
Tennessee	8,084,611	10,674,722
Texas	4,883,852	10,177,311
Utah	171,923	418,289
Vermont	782,338	2,509,189
Virginia	5,416,112	10,404,134
Washington	184,226	499,904
West Virginia	2,241,069	3,374,701
Wisconsin	7,206,126	11,863,739
Wyoming	40,218	224,848
Total	140,537,439	$306,950,040

Other lines of consumption as a total for the United States are represented by the following figures:

	CORDS.	VALUE.
Railroads	1,971,813	$5,126,714
Steamboats	787,862	1,872,083
In mining and amalgamating precious metal	358,074	2,874,593
Other mining operations	266,771	673,692
Manufacture of brick and tile	1,157,522	3,978,331
Manufacture of salt	540,448	121,681
Manufacture of wool	158,208	425 239
Grand total	145.778,137	$321,962,273

The consumption of charcoal in the twenty largest cities in the United States, in the manufacture of iron and in the production of the precious metals, is placed at 74,608,972 bushels, valued at $5,276,736. Maine and Massachusetts imported some wood from Canada.

Car for Transporting Live Fish.

One of the fish cars of the United States Fish Commission was recently dispatched from Washington for California with a cargo of live fish—some 18,000 in number—for stocking Western waters. As described by the Washington *Star*, these cars resemble in external appearance, and to a large extent in internal arrangements, a modern sleeping car. There are compartments at each end, one for the superintendent, the other for a kitchen. Through the middle portion of the car an aisle runs between wide ledges, on each side, for supporting the tin tanks in which the fish are carried. There are two ice boxes next the superintendent's room, for cooling the air of the compartment in which the fish are carried. Delicate fish are transported in pails holding a gallon of water, and accommodating about twenty fish each. These pails are then placed in the water tanks.

By this plan the young fish are protected from being dashed to death by the motion of the cars. In transporting carp the pails are sufficient. The motion of the water due to the motion of the cars helps to keep the water well aerated. Care is taken, however, to renew the water every eight hours, and to remove promptly any fish that may die. The loss by this method of carriage is very small.

The Ice Plant.

This annual plant, the botanical name of which is *Mesembrianthemum crystallinum*, and which is remarkable for the transparent vesicles filled with water, and resembling frozen dewdrops, that cover its fleshy stem and large, thick leaves, is also a striking instance of the elective power of roots, whereby plants can take up from a complex soil the materials proper to them.

M. Mangon has cultivated it for seven or eight years, in La Manche, on the same ground with cabbage, celery, etc., and while these latter had their normal composition, the ice plant dried and burnt, furnished an ash with so much of chlorine and alkalies that at first he was inclined to think that some mistake had been made in weighing. Taking six specimens, he finds the average percentage composition in 100 kilogrammes to be: water, 96·810; combustible matter, 1·800; ash (comprising chlorine, potash, soda, and other mineral matters), 1·390. The plant, then, is formed of a weak solution of alkaline salts, held by a vegetable tissue whose weight reaches less than 2 per cent of the total mass. The ashes formed of salts of soda and potash form nearly half (43 per cent) of the dried plant. This composition recalls that of seaweed. From one hectare (2·47 acres) of ice plants M. Mangon obtained 1,820 kilogrammes of ashes containing 335 kilogrammes of chlorine, as much soda, and 588 kilogrammes of potash, the latter capable of furnishing 863 kilogrammes of carbonate of soda, or nearly as much as is got from incineration of one hectare's yield of the saltwort at Alicante. M. Mangon asks whether the cultivation of the ice plant as a potash plant might not be lucrative under certain conditions; in any case, it would probably be useful, he thinks, in removing from the salt ground on the Mediterranean coasts (its place of origin) the excess of alkaline salts which render it unproductive.

Novel Gas Burner.

The latest novelty in the way of gas burners is now to be seen in action at the Crystal Palace, London, so says the *Lancet*, and all who see it will confess that the inventor has succeeded in getting a most powerful light by the consumption of a very moderate amount of gas. The light is evolved from a cage of platinum wire, which is kept at a white heat. An ordinary gas pipe is fitted with a Bunsen burner of rather special construction, and the flame is further supplied with a jet of air under pressure, so that practically the Lewis light consists of a platinum gauze cage kept at a white heat by means of an automatic blowpipe. It is needless to say that special arrangements are necessary for supplying the air jet to the flame; but the arrangements are comparatively simple, and will not, we think, militate against the introduction of the Lewis light. It need not be said that the light gives off no smoke, and that the combustion of the carbon is perfect. Further, it is not influenced by any amount of draught, and cannot be extinguished or sensibly affected by blowing upon it, so that the light requires no protection in the shape of chimney or globe. The light given off is equal to that of five candles for every cubic foot of gas consumed per hour, and an ordinary Lewis light consumes twelve and a half feet per hour, and gives off the light of fifty candles. The light can easily be made to ventilate. The heat given off is necessarily considerable, and we think the light will prove more generally useful for street lighting than for inside lighting. Unless provided with means of ventilation, the Lewis light would certainly be too hot for use in ordinary sitting rooms.

Photographing Speech.

The *Photo. News* says: The new system of teaching the deaf and dumb by directing them to look at a person speaking, and to note the position of his lips in giving utterance to different sounds, has now been in practice for several years on the Continent; and, as our readers are probably aware, has also been adopted in this country with some success. A Continental teacher has now hit upon a plan of furthering the instruction by having recourse to photography. A model has been chosen whose lips are particularly expressive in their action, and a series of photographs taken of him while pronouncing the different sounds that go to make up a language. Such a "speaking likeness" has been obtained, that, in many cases, even an untrained observer has little difficulty in guessing the letter on the lips of the model, as the photographs are displayed one after another. Mr. Warnerke exhibited several of the pictures at the last meeting of the Photographic Society.

Stopping Engines by Electricity.

We lately described an electric apparatus for closing the valve of an engine and thereby stopping it. This apparatus is now at work in some of the large mills at Dundee, in Scotland. In describing the apparatus at work, the *Dundee Advertiser* says: "The huge engine in Manhattan Works (Colonel Sandeman's), working at from six hundred to seven hundred horse-power, and driving a fly-wheel of about thirty-five tons weight, formerly took two minutes to come to rest after the steam had been taken off. This apparatus has been fitted to it, and the ponderous engine is now brought up in thirty seconds. To see this powerful, majestic piece of machinery, the developer of power for a large range of works, almost immediately brought to a standstill by the mere touching of a button at the far end of the building is an impressive illustration of the easy control of enormous force by wisely ordered arrangements. To mill-owners the utility of the apparatus will be evident."

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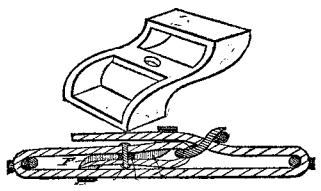
RECENT INVENTION.

Improved Harness Loop.

This invention belongs to the class of loops having two openings for the strap or straps formed by an intermediate plate to which the strap is riveted, and it consists in a metallic double loop with the top plate and the bottom plate, located aside from the plane of the rivet, which is inserted through an intermediate plate. The side plates may be made narrow to save material, or they may be made broad enough to cover the edges of the strap. When made broad they will add materially to the strength of the loop, and at the same time present a surface which may be rendered highly ornamental to the harness. In attaching the strap to the loop,



one end of the strap is to be doubled upon itself as shown in the sectional view, so as to include the intermediate plate between the folds, and the rivet is then to be passed through the folds and said plate and secured in the ordinary manner. The heads of the rivet will thus lie in contact with the yielding leather, and will be less exposed to the danger of being wrenched off than when in contact with the metallic plate. The strain upon the strap or trace, as the case may be, will thus be thrown upon the center of the rivet instead of one end, and being thus equalized, there is less danger of the parts separating under strain. This invention has been patented by Mr. Henry A. Pott, of Cape Girardeau, Mo.

Effects of Iron on Digestion.

In an inaugural dissertation published at Berlin, Dr. A. Düsterhoff records the results of some experiments bearing on this subject. One gramme of fibrin was added to twenty c.c. of artificial gastric juice, and during digestion equivalent quantities of various preparations of iron were also added. At the end of the process the undigested fibrin was dried and weighed, and the quantity of soluble syntonin in the solution was also estimated. The time of digestion was in one case three hours ten minutes, in another it was seven hours and a half. In the first series 0·0614 gramme of metallic iron was in each case added, in the form of pyrophosphate, perchloride, and protolactate respectively. In the second series various other preparations were used, the amount of metallic iron being in each case equivalent to 0 0077 gramme. Other experiments were made with white of egg, the amount of albumen precipitated by boiling after digestion being estimated. The outcome of the experiment is, that the organic salts of iron seriously hinder and check peptic digestion. Probably the hydrochloric acid of the gastric juice displaces the organic acids from the iron salts and so is used up; while the free organic acids in the digestive fluids are far less powerful digestive agents than the hydrochloric acid. But this cannot be the only cause at work, for perchloride and phosphate also tend to hinder digestion. Even reduced iron has a similar effect, for it partially dissolves in the juices, forming chlorides. Its solubility, like that of the phosphate, is however not very great. Ferrous salts seem to interfere less with digestion than ferric salts.—*Practitioner.*

Proposed Improvement in Soda Manufacture.

A very interesting and exhaustive paper on the present position of the soda industry was read before the London Section of the Society of Chemical Industry on January 8, 1883, by Mr. Walter Weldon, F.R.S., chairman of the section. In the course of his remarks the author referred to the conversion of coal into coke by the user, and the utilization of the by-products and gases in the following terms:

There has come to me from Newcastle a very bold but, I venture to think, quite practical suggestion, the result of which can hardly fail to be of enormous importance, not only to the soda industry, but to almost all industries whatever. That suggestion is that the soda maker should entirely cease to use raw coal as fuel, but should convert all his coal into coke, collecting for sale the oil and ammonia evolved during its conversion into coke, and himself using for heating purposes the gases evolved during the coking operation and the coke itself. It is believed that in the Newcastle district, at any rate, by this mode of proceeding the soda maker would obtain his fuel virtually for nothing. In that district there is produced per annum some two millions of tons of very small coal or "duff," which is almost a waste product, and which, singularly enough, yields more oil than the more costly kinds of Newcastle coal, while at the same time yielding a very fair coke, sufficiently good, at any rate, for use in the furnaces of chemical works, especially when its combustion is assisted by that of the gases from the ovens in which the coke is produced; and the value of the oil and ammonia obtained when this "duff" is coked in ovens to which the Jameson system is applied, is greater than the cost of the "duff," *plus* the cost of coking it. And it is probable that improved condensing arrangements will render the yield, if not of oil, at any rate of ammonia, so much greater than the yield hitherto actually realized as to enable the same result to be obtained in the case of ordinary steam coal, not only in the Newcastle district, but in the Lancashire district also. If so, the cost of producing Leblanc soda in both districts will be diminished by almost the total amount of the present cost of Leblanc soda for fuel. I say "almost," because, so far as one can see, the use of raw coal for "mixing" in the blackash process must still be continued. And it seems to me that this idea cannot but be as applicable to almost all other industries as to the soda industry; while the result to the material well being of mankind of its general application, it is utterly beyond the power of any imagination adequately to conceive. This idea means, among other things, cheaper fuel for all purposes, an enormously increased supply of agricultural produce, and the entire suppression of smoke even in the busiest centers of industry. It means that manufacturing towns by and by shall no longer deserve such names as that which Mr. Matthew Arnold recently applied to St. Helens, and may even become tolerable in the sight of Mr. Ruskin. And for my own part I venture to think that the same idea might be applied even to the fuel required for domestic purposes, rendering London absolutely free from smoke, and pea soup fogs only things of tradition. I think that the time will come when our gas works will be replaced, at least to a large extent, by establishments in which coal will be treated for the production of coke, illuminating oils, ammonia, and heating gases: the coke to be burnt in our domestic fire places, the oils to be used for lighting the interiors of our houses, the ammonia to be employed in agriculture, to cheapen and render more abundant our supplies of food, and the gases to be burnt for raising steam for driving dynamos for lighting our streets by the electric arc.

Awards for Inventions to Workmen.

In respect to a scheme of awards to workmen which has been established by Messrs. Denny in their shipbuilding yard at Dumbarton, we learn, says *Iron*, that the committee's annual report for the year just closed is gratifying. The committee state that during the year 1882 they have had under consideration twenty-seven new and four postponed claims. Of these twenty-one have been considered worthy of award, seven have been rejected, and three are still under consideration. When compared with the preceding year, there is a slight decrease in the number of claims received; but, on the other hand, the awards made are all but equal, while some of the inventions are of even greater merit and value than any previously brought forward. The committee also state that the total sum paid in grants is about one-half more than last year, owing to the greater value of some of the claims, and the more liberal scale of payment adopted by the committee, as was intimated at the beginning of the year. The joiners, as in former years, take the first place in the list of the successful claimants, about one-half of the awards going to that department alone. Since the awards scheme was started two and a half years ago, the committee have received seventy-one claims for adjudication, of which number fifty were considered worthy of award; the total sum paid amounting to £171, being £18 in 1880, £62 in 1881, and £91 in 1882. In contradiction to the belief entertained by many that the workmen would soon exhaust their resources in the matter of invention and improvements, the report goes on to show that the reverse is the case, as the past year has witnessed better results than any preceding one. Some of the improvements have evinced considerable inventive talent, and in two cases the highest award the committee are empowered to make was granted.

[According to the above account, fifty useful inventions have been made, for which $855 have been paid, being an average of a trifle over $17 for each. Rather poor encouragement, that, for genius.]

American Fruit for England.

Consul King, writing from Birmingham to the State Department, says: Large quantities of American produce continue to be sold here, and many American "notions" are to be found. One or two firms seem to do a good business in selling American stoves and ranges; and I think that the dealers in American meat find the prejudice against it has generally disappeared, now that, for a time, the supply has been uncertain.

I have spoken before of American apples and have suggested more careful packing, but I venture to urge this again. These apples are generally admitted to be better than European apples, and the taste for them is general, yet several dealers here have told me that they must cease to deal in them, because they arrive in such a condition that it is necessary to put a price upon the few that remain sound which purchasers object to paying.

I have frequently wondered if our grapes, by careful packing, might not compete with Spanish grapes in the English markets. Enormous quantities of Spanish grapes are sold in this country. Very fair ones can be bought at retail at sixpence a pound. They come carefully packed in sawdust, but they are tasteless, and I feel sure that if American grapes could be offered for sale here in as good condition, the variety and superiority and individuality of their flavor would recommend them, even at a slightly higher price.

MR. E. F. LOISEAU, inventor of the process and machinery for manufacturing the pressed fuel from anthracite coal dust, who two years ago lost the sight of one eye from a cataract, has been again unfortunate in suddenly losing the use of the other eye from the same cause. Recently while returning from the works at Port Richmond, he was nearly run over by a cart, and had to be taken home by a gentleman who volunteered to accompany him.

Birds and Telegraph Wires.

Some very curious observations have been made on the German telegraph lines at the instance of the Secretary of the Post Office. Herr Massmann stated in a paper read before the Electrotechnic Society of Berlin, that in districts where there are no trees he found that the smaller birds of prey, such as crows and magpies, are very fond of roosting on telegraph poles, while sparrows, starlings, and swallows frequently alight on them in great numbers. Swallows like to build under the eaves where wires run into telegraph offices, and sometimes cause an "earth" contact.

Contacts between wire and wire are frequently caused by large birds, such as bustards, storks, swans, and wild ducks. They cause the wires to swing and sometimes to break. Accidents of this kind were frequent when the wires ran by highroads, along which young geese were driven to their pastures. Smaller birds, even partridges, are generally killed by the shock of striking the wires. They do not cause much damage to the lines. Holes are often pecked through the poles by woodpeckers (the Picas martius, or black woodpecker, the P. viridis, or green woodpecker, and the P. major, or piebald woodpecker). These birds spare no kind of wood, unprepared pine and oak poles, as well as poles treated with sulphate of copper, chloride of zinc, or sublimate of mercury. Some even state that they will attack creosoted poles. The theory that the birds mistake the vibrations of the wires in the poles for insects humming is doubted by Herr Massmann, who states that they often find insects in the dry poles.

The Latest Electrical Discovery.

The Rev. Mr. Gilbert, during an address at Christ Church the other night, remarks the Otago *Times*, while speaking of the telephone, asked his audience if they would be astonished if he were to tell them that it was now proved to be possible to convey by means of electricity vibrations of light—to not only speak with your distant friend, but actually to see him. The electroscope—the name of the instrument which enabled us to do this—was the very latest scientific discovery, and to Dr. Gnidrah, of Victoria, belonged the proud distinction. The trial of this wonderful instrument took place at Melbourne on the 31st October last in the presence of some forty scientific and public men, and was a great success. Sitting in a dark room, they saw projected on a large disk of white burnished metal the race course at Flemington with its myriad hosts of active beings. Each minute detail stood out with perfect fidelity to the original, and as they looked at the wonderful picture through binocular glasses, it was difficult to imagine that they were not actually on the course itself and moving among those whose actions they could so completely scan.

Spencer B. Driggs.

Spencer B. Driggs died at his residence, 3 East Forty-first street, in this city, on January 26, 1883. He was born near Auburn, N. Y., on January 5, 1822. In 1855 he came to New York city and organized the Driggs Patent Piano Company, his instruments containing valuable improvements. Mr. Driggs will be best remembered by his success in draining the Hackensack meadows, which comprise that great swampy region lying between Jersey City and Newark, N. J., a task which others had attempted and failed in accomplishing. He laid nine miles of iron dike around a part of the meadows, bought by the late S. N. Pike, of Cincinnati. After the land was drained a part was sold to the Pennsylvania Railroad Company, and the round houses and workshops now standing on the meadows were built on the drained land. The railroad company paid $1,200 an acre for the swamp which Mr. Driggs had paid $25 an acre for. Tobacco, corn, potatoes, and hay are now grown in other parts of the meadows which were once a salt marsh. Mr. Driggs' mind was full of novel plans. At the time of his decease he had just completed a new system of running gears for railway cars, that he expected would greatly reduce the costs of transportation.

Archæological Discovery in Asia Minor.

A discovery has been made lately by a Bavarian archæologist, Herr Sester, at the point where the Euphrates bursts through the Taurus Range. Here, in a wild, romantic district, lying between Madatieh and Sanisat, he found a line of megalithic monuments, averaging between 55 and 60 feet in height, and bearing inscriptions They are in a remarkable state of preservation, and Herr Sester has no doubt that they formed a part of some great national sanctuary, dating back some 3,000 years or more. There was formerly at this place a necropolis of the old Commagene kings, so that it seems reasonable to attribute these colossal monuments to this ancient people, the hereditary foes of the Assyrians. Very little is known about them. The classical writers allude to them only in casual passages, and the arrow-headed inscriptions, although mentioning them very often, have hitherto yielded scanty information.

THE new five-cent piece just issued is a little larger and thinner than the old one, and possesses the same lead appearance. On one side is the head of Liberty, the date, and the usual thirteen stars. On the reverse is a V in a wreath of cotton, wheat, and corn, surrounded by the inscriptions, "United States of America" and "E pluribus unum." The letter V in the center does not indicate if the value of the coin is five cents, or five dollars, which seems to be an unfortunate oversight.

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ENGINEERING INVENTIONS.

A car brake of simple device has been patented by Messrs. Alden D. Kiiborn and William F. Smith, of Tuscon, Ariz. Between the brake beams on car trucks the connecting rod is provided with springs so arranged as to produce an elastic connection between the forward and rear brakes.

An improved car coupling has been patented by Mr. Edward S. Carter, of Keokuk, Ia. The invention consists in a coupling loop or link which is arched upward in the direction of its length, one end of the link being secured upon a shaft, so that the points of bearing are confined to the pin heads, and the loop is applied to the drawhead without providing a flat surface for the link, as is required in the ordinary coupling.

An improved car coupling has been patented by Mr. Asa Kenton Owen, of Tennessee, Ill. The invention consists in a drawhead having a recess in the upper surface, and a raised outer end provided with a vertical recess. A tranverse rod passes through the drawhead and through the slot in the disk, and has a plate or block which is in the slot, so that the arm will be swung when the tranverse rod is turned.

Mr. Ross B. Meeker, of Sandford's Corners, N. Y., has patented an improvement which relates to the laying of the rails on railroads. The invention consists of metal ties, stay bars, and joint connections contrived for dispensing entirely with the wood ties now in use. These are of a more substantial and durable construction, and may be adjusted to the rail quite readily.

A noiseless and durable railroad frog has been patented by Mr. William H. Waters, of Muskegon, Mich., which consists in a filling of cast metal applied between the side rails of the frog and around the point by pouring the molten metal so that the block fits snugly beneath the heads of the guard rails and to the flanges, and is thus retained securely in place. The metal becomes chill hardened by the surrounding iron and becomes immovable, consequently there is no rattle when the train is passing over the frog.

Messrs. Dudley W. Haines and Alwyn D. Hankerson, of Readfield, Me., have patented a car coupling of novel and useful construction. By the improvement just patented the brakeman is able to couple and uncouple from either side or top of the car without passing between the cars when being brought together, thus avoiding the danger of being crushed. When it is desired to connect two cars, the coupling pin is raised by a crank attachment operated by a chain, one end of which is secured to the corner of the car, and the other end to the crank which raises the pin.

An improved rock drill of light, simple, but durable construction has been patented by Mr. William J. Barber, of Covington, Ind. It consists of a screw threaded drill rod mounted upon a firmly planted tripod, and connected with it is a cam wheel furnished with a handle for turning the same, by means of which wheel the drill rod is elevated in the air and then suddenly permitted to fall, and at the same time the drill rod is rotated upon its axis. As the hole is deepened the drill is readjusted on the rod, so as to reach deeper in the drill hole.

An improved combustion chamber for steam boilers has been patented by Mr. James Scott, of Pittsburg, Pa. The invention consists of a combustion chamber supplied with gases from a blast furnace using either coke, coal, or charcoal, and as soon as the chamber becomes heated, air is forced by a blower into the combustion chamber. The air passing through the passages to the chamber becomes highly heated and mingles with the gases in the best possible conditions for promoting combustion. In this manner the heated gases are utilized, and it is claimed that no solid fuel is required to maintain combustion.

A system of transporting cars on a single track elevated above the ground is the subject of a patent issued to Charles F. M. Lartigue, Paris, France. The invention consists of a light rail mounted upon a frame, which is firmly planted in the ground. Upon this rail the car is made to run, which is constructed of light metal and mounted upon two wheels, and which carries the panniers of the wagon on each side. The object of the inventon is to provide a cheap and simple method of transporting merchandise and troops, and is especially applicable to removing coal and ores from mines.

An improved tipping wagon has been patented by Mr. Henry Grafton, of London, England. The wagon is of such construction that the truck may be tipped at either side (or end, as the case may be) and the truck body may be given a combined movement of translation and oscillation, whereby the load may be discharged quite clear of the rails, and even to a greater distance therefrom than is possible with an ordinary pivoted truck of the same height and form of body, the tipping and righting of the body being an easy operation, requiring no gear liable to be fouled by dirt or to get out of order with rough usage.

An improved propeller, the object of which is to afford a simple arrangement of the blades by which the vessel may be steered in case of injury of the steering apparatus, has been patented by Mr. Ephraim Shay, of Haring, Mich. The invention consists in the combination with a tube, situated within the stern of the hull of a vessel and open on each side, of a gearing apparatus operated by a shaft, by which are set in motion two propellers fixed on oppositely rotating shafts, whereby the two propellers will move in opposite directions, but co-operate always to force the water in the same direction.

An improved caloric engine has been patented by Mr. Thomas Beesley, of Muscatine, Ia. This invention relates to the application of force generated by expansion of air and water by electric currents, this force being utilized for action on a piston fitted for reciprocation in a cylinder. For heating and expanding the air and converting the water to steam, an electric arc is used inside the generating chamber. The combining of a pump for supplying water in jets, and a pump for supplying air, with a generating chamber, heated by an electric current for producing expansion of the air, and conversion of the water to steam, comprises the prime feature of the invention.

A novel car coupling has been patented by Mr. George A. Cline, of Philadelphia, Pa., which consists in a drawhead in which is pivoted a U-shaped piece having a long and a short shank, provided with hooks at the ends. The U-shaped piece is pressed in the direction in which the hooks project by a spring acting on its rear end, whereby, when two drawheads strike together, the hooks will catch on each other and couple the cars automatically. If the cars are to be uncoupled, the hooks of the U-shaped piece are moved from each other by turning shafts provided with cam-lugs which act on wings at the rear ends of the pivoted U-shaped pieces, and thus press these pieces in the inverse direction of that in which they are pressed by the springs, and permit them to be disengaged.

Mr. Leo Ehrlich, of St. Louis, Mo., has patented a portable transfer track for street railroads, the object of which is to provide means for enabling a car to "skirt" or pass around any obstruction on the road without the necessity of jumping the track. The invention is designed more particularly for street cars, whose travel is frequently arrested by the breaking down of heavy vehicles on the track, but it may be used upon steam railways, in transferring cars from one track to another, or from a track to a siding without the necessity of running to a switch. To accomplish this a pair of skid rails with tapering ends for each track and a set of transfer rails are provided, to span the skid rails. Upon these rails platform truck frames are placed to support the car which is being transferred from one track to the other.

A stock car of improved form has been patented by Mr. Adolph V. Anderson, of Virginia City, Nevada. The invention consists in a stock car with extension partitions forming stalls, and having at the top feed compartments provided with discharge tubes, and at the ends water tanks, provided with discharge pipes and faucets, so that the feed and water will be discharged into feed boxes and water troughs in the stalls in a most effective manner. The rear ends of the stalls are separated by bars hinged to the car frame, and engaging with the edges of the extension partitions to prevent the animals from backing into adjacent stalls. To the feed box bottom is attached an arm, which is connected by a bar with the pivoted bars of the extension partition, so that the bottom of the feed box will be swung up and down by the extension and contraction of the said partition. The water troughs are hung upon sliding plates connected by rods provided with levers which are pivoted to the car frame, and connected with the water discharging faucets, held up by springs, so that the variation in the amount of water in the troughs will operate the faucets to admit and shut off the supply. The cars are connected by flexible pipes and valves, so that the tanks of all the cars in the train can be filled from one car or source.

MECHANICAL INVENTIONS.

Mr. David G. Wyeth, of Newark, O., has patented improvements in buggy tops, the principal advantages of which rest in placing the braces inside the top, rendering it easy for the occupant to open or close the top without leaving his seat.

An improved fanning apparatus for cooling the atmosphere in rooms has been patented by Mr. Jacob Reimers, of Davenport, Ia. The invention consists of a series of fan wings or blades mounted on a rotary shaft, and contained within a casing which is provided with a series of tubular arms or pipes for conducting the air in different directions.

A simple wire twister has been patented by Messrs. Axel L. Sjolinder and Emanuel Larson, of South Pueblo, Col. It consists of a base plate having a concave channel on its lower side, through which passes the wire to be twisted, and with a slotted cylindrical twister located in the middle of the channel, which is operated by beveled pinion wheels turned by a crank.

A fish trap has recently been patented by Mr. James M. Frazer, of Portland, Ore. The invention consists in a trap or cage having converging rows of staple shaped bars affixed to an upright frame, the cage or trap being elevated or lowered by any of the known means. A lead net having a mouth, which is held against the action of the current conducts the fishes into the trap.

An adjustable saw guide, designed to do away with the ordinary and dangerous mode of setting or guiding circular saws, has been patented by Mr. Hiram Carman, of Portland, Pa. By the ordinary method the saws are guided while in motion by means of two set screws—one on each side—carried by stationary jaws. In this improved guide the jaws are made adjustable by means of a screw, so that they can be moved to guide the saw while the saw is in motion without danger to the sawyer.

An improved trap for preventing foul gases from rising in waste pipes has been patented by Mr. Herman Pietsch, of Flatbush, N. Y. The invention consists in a trap formed of two vessels, one contained within the other. Into the inner vessel an inlet pipe projects from the top of the outer vessel, which inlet pipe is provided with an outwardly projecting spout or collar, whereby, when the suction in the soil pipe is too great, the valve opens and admits air, thus preventing the siphoning out of the water in the inner vessel of the trap.

Mr. Peter Straith, of Toronto, Canada, has recently patented a machine for sharpening the knives of reapers and mowers. In use the cutter bar is held by an adjustable frame constructed so that the bar can be turned back from the stone. Devices are also provided whereby the cutters are given an oscillating movement upon the stone. On the axle of the grindstone a pinion meshes into the driving pinion, which is so proportioned and arranged that the knife cannot reverse its movement on the stone in one place more than once, thus insuring an even wear upon the stone.

An improved washing machine has been patented by John F. Adams, of Eliza, Ill. The invention consists of a tub lined with galvanized sheet iron, and furnished with a lower and upper set of rubbers and a lever by which these several rubbers are operated at once. The clothes to be washed are placed between the upper and lower rubbers. Then by working the lever horizontally the clothes will be forced between the rubbers. By working the lever vertically the clothes are pounded, so that the washing is done quickly and thoroughly.

An improved shutter worker, arranged in such a way that window blinds and shutters may be controlled from the interior of the building, has been patented by Mr. John W. Harrison, of Wheeling, W. Va. The invention consists in a shaft passing through the wall and operating bevel pinion wheels which connect this shaft with the hinge of the blind, and by which the blind may be brought into any position required by turning the handle attached to the shaft from the inside of the house. Devices are likewise furnished for holding the blind in the position desired.

A novel window shutter opener has been patented by Messrs. John J. Donahoe and Peter J. Finn, of New Orleans, La. By this arrangement the shutter is fastened by a pin, and is operated by a rod which is suspended to a lever. The lever of each window is attached by a rod to another longer lever, which is so adjusted that the operator by pulling upon a single rod detaches the fastenings of all the shutters on one side of a building by one operation. Springs are arranged between the shutter and window sill for forcing the shutter open when the pin is withdrawn.

An improved lathe for turning ovals, hat blocks, etc., has been patented by Mr. Michael Quinn, of Fishkill Landing, N. Y. The invention consists in a lathe constructed with a shaft carrying a stationary plate, and an adjustable eccentric plate, also a plate carrying a work holding plate, and provided with flanges to receive and slide upon the adjustable plate provided with flanges to receive and slide upon a bar connected with a pulley which revolves upon the stationary shaft. The work holding plate is thus made to slide back and forth as it is rotated.

Mr. Charles E. Brennan, of Charlottesville, Va., has recently patented an automatic fire extinguisher, the object of which is to provide an apparatus that shall be brought into operation automatically when a fire occurs in a building or other place contiguous to the machine. In case a fire occurs in a room, as soon as the temperature reaches a high enough point to fuse metal, a weight and lever will thereby be released, and falling opens a valve which connects with the pipes for conveying water from the tank or reservoir. The pipes are provided with sprinkling attachment and extend around the room. The moment the valve is relieved by the fusible metal the water commences to flow through the sprinklers about the room, and thus the fire is subdued.

A novel rice hulling machine has been patented by Mr. William C. Howard, of Grahamville, S. C. The invention consists of a stone mounted on a platform which may be elevated or depressed by weighted levers attached to the platform, their fulcrum resting on the frame which supports the machine. The stone is concave in its upper side, and in it revolves a wood cylinder faced with steel plates which answer the double purpose of feeding the rice to the stone and hulling the kernel of its chaff. Between the cylinder and the steel plates strips of India-rubber are interposed, which allow the plates to yield to the rice under treatment. The object of the adjusting weights is to regulate the pressure upon the rice as it is being fed between the cylinder and stone.

Mr. William A. Allen, of Jersey City, N. J., has patented an improved drying house or kiln. The improvements relate to kilns for drying kindling wood material in mass, and particularly the slabs or refuse from saw mill logs, which, being thoroughly water-soaked when sawed from the log, requires to be dried in order to fit it for use. The great difficulty experienced in this work with the kilns heretofore employed has been in getting rid of the moist air or vapors driven off from the mass of material. This condenses rapidly, and unless means are provided for keeping it in a heated and rarefied condition, it is a source of great trouble and annoyance. Mr. Allen has devised the means for obviating the difficulties named and for insuring the proper working of the drying apparatus at all seasons of the year.

A novel sewing machine motor has been patented by Mr. David L. Miller, of Madison, N. J. This motor is intended to be operated by the foot or by the act of rocking. A rocking platform is provided for the operator to rest his feet upon, while he sits in a chair the latter of which is attached to the platform, which platform is pivoted to an upright lever through which the power is transmitted. The act of leaning back and forward by the operator oscillates the chair, which transmits motion and power to the upright lever. The upper end of the vertical lever is provided with a double rack and pinion, which is driven by the power conveyed by the foot rest or by the rocking movement of the operator, as the case may be. This invention possesses much ingenuity, and is very simple and inexpensive to construct.

MISCELLANEOUS INVENTIONS.

A spoon holder for cooking vessels has been patented by Mr. John A. Hemsteger, of Piqua, O. The invention consists in combining with a sauce pan or other vessel used in cooking operations, a device for holding a spoon, the object being to save the trouble and annoyance caused by the spoon slipping into the vessel.

Mr. George A. Fitch, of Oakland, N. Y., has patented an improved speaking telephone. This invention relates to an improvement in receiving instruments for the electrical speaking telephone. The invention consists of an apparatus in which a strip of suitable material is connected to a diaphragm and passed between two rotating rollers, one of which rollers is supported in the armature of an electro-magnet. The armature is provided with an adjusting spring to prevent it from responding to induced or minor currents. When an electric current is passed through the rotating rollers and the strip, the friction between the said parts will be increased or diminished in proportion to the varying intensity of the current, and a corresponding vibration of the diaphragm will be produced.

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The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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Peck's Patent Drop Press. See adv., page 110.

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Gould & Eberhardt's Machinists' Tools. See adv., p. 110.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 108.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 108.

Combined Concentric and Eccentric Universal and Independent Jaw Chucks. The Pratt & Whitney Co., Hartford, Conn.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423. Pottsville, Pa. See p. 108.

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See New American File Co.'s Advertisement, p. 94.

Curtis Pressure Regulator and Steam Trap. See p. 76.

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Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) J. E. asks: When will a crosscut saw straight on the bottom cut the faster—when drawn straight across the log, or by giving it a rocking motion? Why are are crosscut saws made round on the bottom instead of on top? What is the cheapest power for a small country work shop? A. A crosscut saw is made bowing to make it cut faster and to accommodate the wear by sharpening. A saw worked by hand naturally rocks a little, which is advantageous. The cheapest reliable power is steam, unless you are situated so as to have water power. A windmill is good and cheap as far as it goes.

(2) G. P. W. writes: 1. I want to elevate water (about 600 gallons daily) 35 feet to a tank. What is the cheapest and best means to employ? A. Any house force pump will answer your purpose. 2. How should a tank be built when placed in the second story of a dwelling, so as not to leak? A. The best tanks for houses are what are called staved tanks, made of pine or cedar, like a churn, on a taper, with the hoops driven downward. Any carpenter can make them. Box tanks are often used, but are not as reliable as staved tanks. 3 In putting in a furnace for heating a dwelling, should the smokepipe enter the chimney at once, or could it run horizontally 12 or 15 feet as well as not, and be inclosed in a hot air flue connected with a register above; and would it pay to do it? A. If your chimney has a good draught, there is no objection to carrying the pipe 12 or 15 feet and covering with a warm air chamber. If you have a heater that has a large radiating surface in proportion to grate, the pipe should not be hot enough to pay for inclosing, as a source of heat to supply a register. 4. How should a chimney for a furnace be built, and how large? A. The ordinary chimneys of dwellings are generally large enough for heaters. No chimney flue should be less than 8 inches square—8 inches by 12 inches would be best.

(3) O. S. F. asks if it would be safe to run a three-quarter inch common pipe into the firebox and out again; pipe bent in shape of a yoke. Steam is then carried about fifty feet from boiler. I wish to get as dry steam as possible. I use it to steam carpets, feathers, hair, etc. If it is a safe plan, please tell me the best way to arrange it. A. It need not be dangerous, except you carry a high pressure, which you do not want. You want superheated steam, which you can have with low pressure. The way you propose to arrange the pipe is very well, but there must be a *constant* current of steam through it, or your pipe will soon burn out.

(4) J. K. H. writes: I am using a canvas belt for polishing up whiffletrees. I find difficulty in making the quartz adhere to the canvas. I have been using common glue. Is there any kind of cement that would answer the purpose better than glue? A. There is no cement that is equal to the *best glue* for sand belts. Common glue is poor stuff for any use. Use only the best quality of *light brown glue*, and select it yourself. By bending a few pieces in your hands, the weak, brittle glue will break easy and fly; the strong, tough glue will bend with difficulty, and finally splinter and not fly into pieces.

(5) R. S. F. asks: 1. When two induction coils are arranged so that the secondary current from the first shall traverse the primary wire of the second, is a break necessary, or will the secondary current induce currents like itself? A. No break is necessary in the second coil, as the secondary current is intermittent and alternating in its character. 2 Is the current thus induced in the second coil stronger than if the same battery power were used direct to it? A. No; it is of higher potential; but the quantity will be small. 3. How long a Geissler's tube will a coil giving a spark one-eighth inch long illuminate? A. Six inches.

(6) J. M. writes: I contend that if a person jump up perpendicularly from the rear platform of a freight car, shielded from the wind by the back of the car, that he will come down in the same place from which he jumped. My opponent disputes it. A. Theoretically he would not come down in exactly the same place, but practically, under your conditions, he would. In reality he loses an infinitesimal part of his forward velocity during the time he is not on the platform.

(7) W. T. asks of how much advantage is "lead" on a locomotive's valves. A. Lead is necessary to the smooth working of the engine. It furnishes an elastic cushion to absorb the momentum of the reciprocating parts, and gradually taking up all the "slack" of the joints and connections. By this means, also, the piston has the full pressure of the steam at or slightly before the change in its direction of movement.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 6, 1883,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

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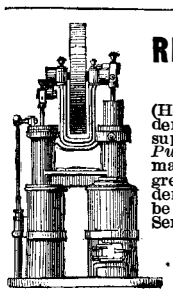

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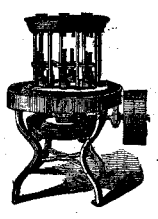

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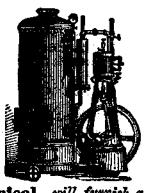

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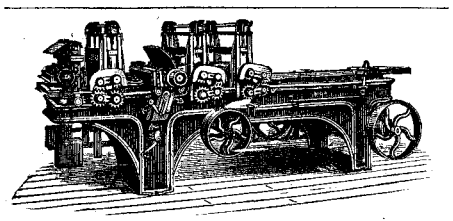

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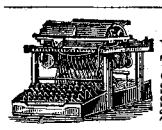

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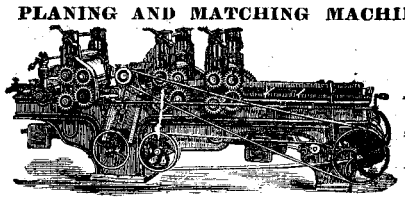

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INTERNATIONAL Electric Exhibition, VIENNA, 1883.

The Commission of the International Electric Exhibition in Vienna, 1883, gives due notice to the public that this Exhibition is to take place in the course of this year, to be opened on the **1st August** and to be closed on the **31st October,** and cordially invite Exhibitors and Visitors.

The Regulations and the blanks necessary for Applications for space are to be had at the **Austrian-Hungarian Consuls.**

The objects to be exposed will comprise all Machinery, Apparatus, and Implements connected with Electrotechnic.

It will certainly afford a good opportunity to inventors to show their latest improvements.

This Exhibition is greatly favored by the Austrian Government, and will be held in the Rotunda of the well remembered Universal Exhibition of 1873.

Exhibitors are requested to procure the necessary papers at once.

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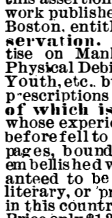

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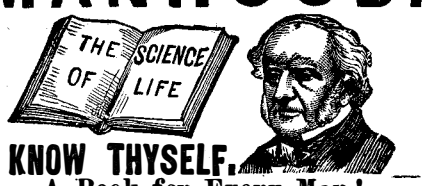

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THIRTY-EIGHTH ANNUAL REPORT
OF THE
New-York Life Insurance Co.
OFFICE, Nos. 346 and 348 BROADWAY.
JANUARY 1, 1883.

Amount of Net Cash Assets, January, 1, 1882.....$45,130,006.86

REVENUE ACCOUNT.

Premiums	$9,604,788.38	
Less deferred premiums January 1, 1882	452,161.00—	$9,152,627.38
Interest and rents (including realized gains on real estate sold)	3,089,273.21	
Less interest accrued January 1, 1882	291,254.80—	2,798,018.41—$11,950,645.79
		$57,080,652.65

DISBURSEMENT ACCOUNT.

Losses by death, including Reversionary additions to same	$1,955,292.00	
Endowments matured and discounted, including Reversionary additions to same	427,258.95	
Annuities, dividends, and returned premiums on cancelled policies	3,827,758.76	
Total paid Policy-holders	$6,210,309.71.	
Taxes and re-insurances	234,678.27	
Commissions, brokerages, agency expenses and physicians' fees	1,332,038.38	
Office and law expenses, salaries, advertising, printing, &c	385,111.18—	$8,162,137.54
		$48,918,515.11

ASSETS.

Cash in bank, on hand, and in transit (since received)	$1,276,026.67	
Invested in United States, New York City and other stocks, (market value, $19,953,956.52)	18,072,074.81	
Real Estate	4,133,065.13	
Bonds and mortgages, first lien on real estate, (buildings thereon insured for $17,950,000.00 and the policies assigned to the Company as additional collateral security)	19,306,940.16	
Temporary loans, (secured by stocks, market value, $5,191,139.50)	4,313,000.00	
*Loans on existing policies, (the reserve held by the Company on these policies amounts to $2,690,961)	494,032.23	
*Quarterly and semi-annual premiums on existing policies, due subsequent to January 1, 1883	540,555.91	
*Premiums on existing policies in course of transmission and collection.	394,395.19	
Agents' balances	62,424.95	
Accrued interest on investments January 1, 1883	326,000.06—	$48,918,515.11
Excess of market value of securities over cost		1,881,881.71

**A detailed schedule of these items will accompany the usual annual report filed with the Insurance Department of the State of New York.*

CASH ASSETS, January 1, 1883..... $50,800,396.82

Appropriated as follows:

Adjusted losses, due subsequent to January 1, 1883	$351,451.21	
Reported losses, awaiting proof, &c	138,970.23	
Matured endowments, due and unpaid, (claims not presented)	53,350.43	
Annuities, due and unpaid (uncalled for)	6,225.86	
Reserved for re-insurance on existing policies; participating insurance at 4 per cent. Carlisle net premium; non-participating at 5 per cent. Carlisle net premium	43,174,402.78	
Reserved for contingent liabilities to Tontine Dividend, Fund, January 1, 1882, over and above a 4 per cent. reserve on existing policies of that class	$2,054,244.03	
Addition to the Fund during 1882 for surplus and matured reserves	1,109 966.00	
	$3,164,210.03	
DEDUCT— Returned to Tontine policy-holders during the year on Matured Tontines	1,072,837.87	
Balance of Tontine Fund January 1, 1883	2,091,372.16	
Reserved for premiums paid in advance	35,782.36	
		$45,851,555.03
Divisible Surplus at 4 per cent		**4,948,841.79**
Surplus by the New York State Standard at 4½ per ct., estimated at		**10,000,000.00**

From the undivided surplus of $4,948,841 the Board of Trustees has declared a Reversionary dividend to participating policies in proportion to their contribution to surplus, available on settlement of next annual premium.

During the year 12,178 policies have been issued, insuring $41,325,520.

Number of Policies in force	Jan. 1, 1879, 45,005. Jan. 1, 1880, 45,705. Jan. 1, 1881, 48,548. Jan. 1, 1882, 53,927. Jan. 1, 1883, 60,150.	Amount at risk	Jan. 1, 1879, $125,232,144. Jan. 1, 1880, 127,417,763. Jan. 1, 1881, 135,726,916. Jan. 1, 1882, 151,760,824. Jan. 1, 1883, 171,415,097.
Death-claims paid	1878, $1,687,676. 1879, 1,569,854. 1880, 1,731,721. 1881, 2,013,203. 1882, 1,955,292.	Income from Interest	1878, $1,948,665. 1879, 2,033,650. 1880, 2,317,889. 1881, 2,432,654. 1882, 2,798,018.
Divisible Surplus at 4 per cent.	Jan. 1, 1879, $2,811,436. Jan. 1, 1880, 3,120,371. Jan. 1, 1881, 4,295,096. Jan. 1, 1882, 4,827,036. Jan. 1, 1883, 4,948,841.		

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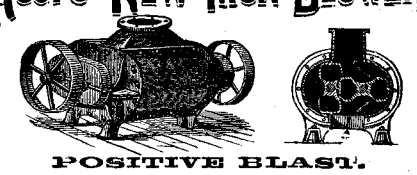

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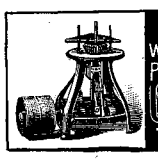

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WILL CUT 100 SEATS 4½ X ⅝ INCH PER DAY. OTHER SIZES IN PROPORTION
See Sci. Am. VOL. 45, No. 5, 181
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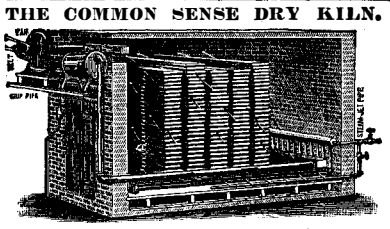

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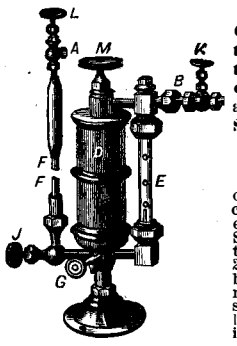

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New Caloric Pumping Engine
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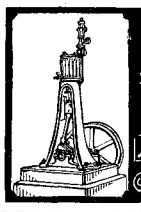

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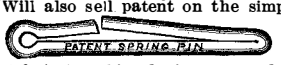

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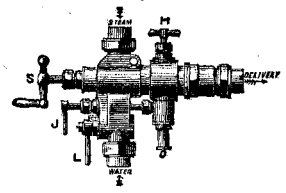

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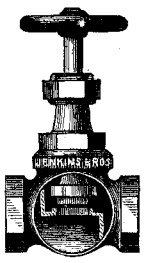

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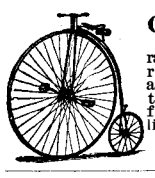

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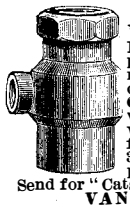

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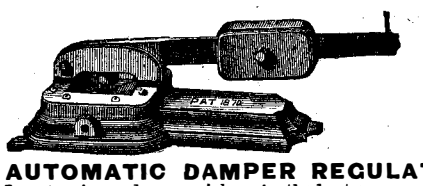

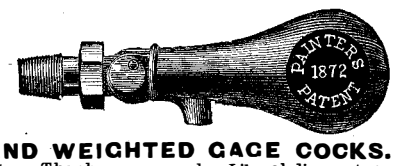

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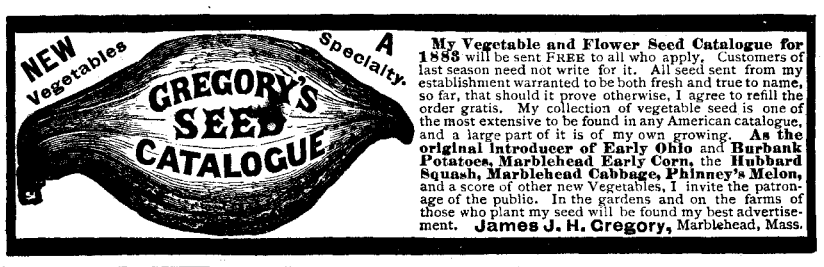

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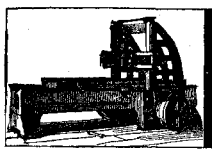

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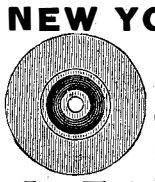

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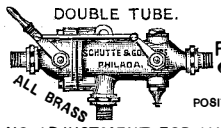

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